



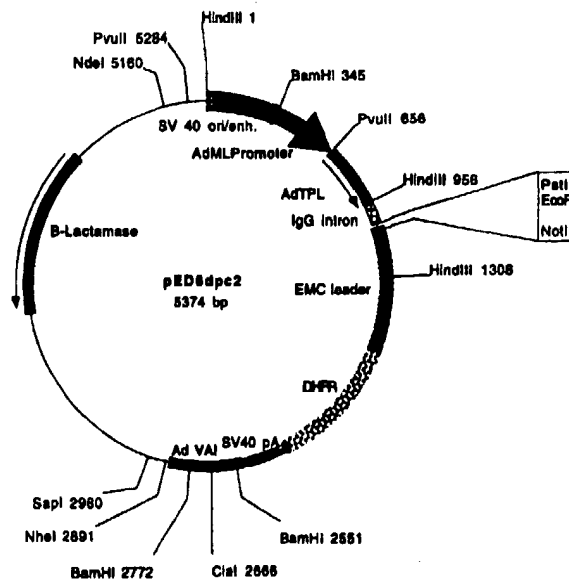
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**(54) Title:** SECRETED PROTEINS AND POLYNUCLEOTIDES ENCODING THEM

**(57) Abstract**

Novel polynucleotides and the proteins encoded thereby are disclosed.



Plasmid name: pED6dpc2  
Plasmid size: 5374 bp

Comments/References: pED6dpc2 is derived from pED6dpc1 by insertion of a new polylinker to facilitate cDNA cloning. 537 cDNAs are cloned between EcoRI and NotI. pED vectors are described in Kaufman et al.(1991), NAR 19: 4485-4490.

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## SECRETED PROTEINS AND POLYNUCLEOTIDES ENCODING THEM

5           This application is a continuation-in-part of application Ser. No. 60/XXX,XXX (converted to a provisional application from non-provisional application Ser. No. 08/822,167), filed March 21, 1997, which is incorporated by reference herein.

FIELD OF THE INVENTION

10           The present invention provides novel polynucleotides and proteins encoded by such polynucleotides, along with therapeutic, diagnostic and research utilities for these polynucleotides and proteins.

BACKGROUND OF THE INVENTION

15           Technology aimed at the discovery of protein factors (including e.g., cytokines, such as lymphokines, interferons, CSFs and interleukins) has matured rapidly over the past decade. The now routine hybridization cloning and expression cloning techniques clone novel polynucleotides "directly" in the sense that they rely on information directly related to the discovered protein (i.e., partial DNA/amino acid sequence of the protein  
20 in the case of hybridization cloning; activity of the protein in the case of expression cloning). More recent "indirect" cloning techniques such as signal sequence cloning, which isolates DNA sequences based on the presence of a now well-recognized secretory leader sequence motif, as well as various PCR-based or low stringency hybridization cloning techniques, have advanced the state of the art by making available large numbers of  
25 DNA/amino acid sequences for proteins that are known to have biological activity by virtue of their secreted nature in the case of leader sequence cloning, or by virtue of the cell or tissue source in the case of PCR-based techniques. It is to these proteins and the polynucleotides encoding them that the present invention is directed.

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### SUMMARY OF THE INVENTION

In one embodiment, the present invention provides a composition comprising an isolated polynucleotide selected from the group consisting of:

- 5 (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:1;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:1 from nucleotide 707 to nucleotide 1783;
- (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:1 from nucleotide 368 to nucleotide 838;
- 10 (d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone bp783\_3 deposited under accession number ATCC 98369;
- (e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone bp783\_3 deposited under accession number ATCC 98369;
- 15 (f) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone bp783\_3 deposited under accession number ATCC 98369;
- (g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone bp783\_3 deposited under accession number ATCC 98369;
- 20 (h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:2;
- (i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:2 having biological activity, the fragment comprising the amino acid sequence from amino acid 174 to amino acid 183 of SEQ ID NO:2;
- 25 (j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;
- (k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and
- 30 (l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).

Preferably, such polynucleotide comprises the nucleotide sequence of SEQ ID NO:1 from nucleotide 707 to nucleotide 1783; the nucleotide sequence of SEQ ID NO:1 from nucleotide 368 to nucleotide 838; the nucleotide sequence of the full-length protein

coding sequence of clone bp783\_3 deposited under accession number ATCC 98369; or the nucleotide sequence of a mature protein coding sequence of clone bp783\_3 deposited under accession number ATCC 98369. In other preferred embodiments, the polynucleotide encodes the full-length or a mature protein encoded by the cDNA insert  
5 of clone bp783\_3 deposited under accession number ATCC 98369. In yet other preferred embodiments, the present invention provides a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:2 from amino acid 1 to amino acid 44.

Other embodiments provide the gene corresponding to the cDNA sequence of SEQ ID NO:1.

10 In other embodiments, the present invention provides a composition comprising a protein, wherein said protein comprises an amino acid sequence selected from the group consisting of:

- (a) the amino acid sequence of SEQ ID NO:2;
  - (b) the amino acid sequence of SEQ ID NO:2 from amino acid 1 to  
15 amino acid 44;
  - (c) fragments of the amino acid sequence of SEQ ID NO:2 comprising the amino acid sequence from amino acid 174 to amino acid 183 of SEQ ID NO:2; and
  - (d) the amino acid sequence encoded by the cDNA insert of clone  
20 bp783\_3 deposited under accession number ATCC 98369;
- the protein being substantially free from other mammalian proteins. Preferably such protein comprises the amino acid sequence of SEQ ID NO:2 or the amino acid sequence of SEQ ID NO:2 from amino acid 1 to amino acid 44.

In one embodiment, the present invention provides a composition comprising an  
25 isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:3;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:3 from nucleotide 99 to nucleotide 1514;
- 30 (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:3 from nucleotide 171 to nucleotide 1514;
- (d) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:3 from nucleotide 57 to nucleotide 623;

- (e) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone bu45\_2 deposited under accession number ATCC 98369;
- 5 (f) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone bu45\_2 deposited under accession number ATCC 98369;
- (g) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone bu45\_2 deposited under accession number ATCC 98369;
- 10 (h) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone bu45\_2 deposited under accession number ATCC 98369;
- (i) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:4;
- 15 (j) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:4 having biological activity, the fragment comprising the amino acid sequence from amino acid 231 to amino acid 240 of SEQ ID NO:4;
- (k) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(h) above;
- 20 (l) a polynucleotide which encodes a species homologue of the protein of (i) or (j) above ; and
- (m) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(j).

Preferably, such polynucleotide comprises the nucleotide sequence of SEQ ID NO:3 from nucleotide 99 to nucleotide 1514; the nucleotide sequence of SEQ ID NO:3 from  
25 nucleotide 171 to nucleotide 1514; the nucleotide sequence of SEQ ID NO:3 from nucleotide 57 to nucleotide 623; the nucleotide sequence of the full-length protein coding sequence of clone bu45\_2 deposited under accession number ATCC 98369; or the nucleotide sequence of a mature protein coding sequence of clone bu45\_2 deposited under accession number ATCC 98369. In other preferred embodiments, the polynucleotide  
30 encodes the full-length or a mature protein encoded by the cDNA insert of clone bu45\_2 deposited under accession number ATCC 98369. In yet other preferred embodiments, the present invention provides a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:4 from amino acid 1 to amino acid 175.

Other embodiments provide the gene corresponding to the cDNA sequence of SEQ ID NO:3.

In other embodiments, the present invention provides a composition comprising a protein, wherein said protein comprises an amino acid sequence selected from the group  
5 consisting of:

- (a) the amino acid sequence of SEQ ID NO:4;
  - (b) the amino acid sequence of SEQ ID NO:4 from amino acid 1 to amino acid 175;
  - (c) fragments of the amino acid sequence of SEQ ID NO:4 comprising  
10 the amino acid sequence from amino acid 231 to amino acid 240 of SEQ ID NO:4;  
and
  - (d) the amino acid sequence encoded by the cDNA insert of clone  
- bu45\_2 deposited under accession number ATCC 98369;
- the protein being substantially free from other mammalian proteins. Preferably such  
15 protein comprises the amino acid sequence of SEQ ID NO:4 or the amino acid sequence  
of SEQ ID NO:4 from amino acid 1 to amino acid 175.

In one embodiment, the present invention provides a composition comprising an isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID  
20 NO:5;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID  
NO:5 from nucleotide 87 to nucleotide 980;
- (c) a polynucleotide comprising the nucleotide sequence of SEQ ID  
NO:5 from nucleotide 147 to nucleotide 980;
- (d) a polynucleotide comprising the nucleotide sequence of the full-  
25 length protein coding sequence of clone ct864\_4 deposited under accession  
number ATCC 98369;
- (e) a polynucleotide encoding the full-length protein encoded by the  
cDNA insert of clone ct864\_4 deposited under accession number ATCC 98369;
- (f) a polynucleotide comprising the nucleotide sequence of a mature  
30 protein coding sequence of clone ct864\_4 deposited under accession number  
ATCC 98369;
- (g) a polynucleotide encoding a mature protein encoded by the cDNA  
insert of clone ct864\_4 deposited under accession number ATCC 98369;

(h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:6;

(i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:6 having biological activity, the fragment comprising the amino acid sequence from amino acid 144 to amino acid 153 of SEQ ID NO:6;

(j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;

(k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and

(l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).

Preferably, such polynucleotide comprises the nucleotide sequence of SEQ ID NO:5 from nucleotide 87 to nucleotide 980; the nucleotide sequence of SEQ ID NO:5 from nucleotide 147 to nucleotide 980; the nucleotide sequence of the full-length protein coding sequence of clone ct864\_4 deposited under accession number ATCC 98369; or the nucleotide sequence of a mature protein coding sequence of clone ct864\_4 deposited under accession number ATCC 98369. In other preferred embodiments, the polynucleotide encodes the full-length or a mature protein encoded by the cDNA insert of clone ct864\_4 deposited under accession number ATCC 98369. In yet other preferred embodiments, the present invention provides a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:6 from amino acid 189 to amino acid 290.

Other embodiments provide the gene corresponding to the cDNA sequence of SEQ ID NO:5.

In other embodiments, the present invention provides a composition comprising a protein, wherein said protein comprises an amino acid sequence selected from the group consisting of:

(a) the amino acid sequence of SEQ ID NO:6;

(b) the amino acid sequence of SEQ ID NO:6 from amino acid 189 to amino acid 290;

(c) fragments of the amino acid sequence of SEQ ID NO:6 comprising the amino acid sequence from amino acid 144 to amino acid 153 of SEQ ID NO:6; and



(d) the amino acid sequence encoded by the cDNA insert of clone ct864\_4 deposited under accession number ATCC 98369;

the protein being substantially free from other mammalian proteins. Preferably such protein comprises the amino acid sequence of SEQ ID NO:6 or the amino acid sequence of SEQ ID NO:6 from amino acid 189 to amino acid 290.

In one embodiment, the present invention provides a composition comprising an isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:7;
- 10 (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:7 from nucleotide 242 to nucleotide 580;
- (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:7 from nucleotide 1 to nucleotide 387;
- (d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone df396\_1 deposited under accession number ATCC 98369;
- 15 (e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone df396\_1 deposited under accession number ATCC 98369;
- (f) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone df396\_1 deposited under accession number ATCC 98369;
- 20 (g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone df396\_1 deposited under accession number ATCC 98369;
- (h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:8;
- 25 (i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:8 having biological activity, the fragment comprising the amino acid sequence from amino acid 51 to amino acid 60 of SEQ ID NO:8;
- 30 (j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;
- (k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and

(l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).

Preferably, such polynucleotide comprises the nucleotide sequence of SEQ ID NO:7 from nucleotide 242 to nucleotide 580; the nucleotide sequence of SEQ ID NO:7 from nucleotide 1 to nucleotide 387; the nucleotide sequence of the full-length protein coding sequence of clone df396\_1 deposited under accession number ATCC 98369; or the nucleotide sequence of a mature protein coding sequence of clone df396\_1 deposited under accession number ATCC 98369. In other preferred embodiments, the polynucleotide encodes the full-length or a mature protein encoded by the cDNA insert of clone df396\_1 deposited under accession number ATCC 98369. In yet other preferred embodiments, the present invention provides a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:8 from amino acid 1 to amino acid 48.

Other embodiments provide the gene corresponding to the cDNA sequence of SEQ ID NO:7.

In other embodiments, the present invention provides a composition comprising a protein, wherein said protein comprises an amino acid sequence selected from the group consisting of:

- (a) the amino acid sequence of SEQ ID NO:8;
- (b) the amino acid sequence of SEQ ID NO:8 from amino acid 1 to amino acid 48;
- (c) fragments of the amino acid sequence of SEQ ID NO:8 comprising the amino acid sequence from amino acid 51 to amino acid 60 of SEQ ID NO:8; and
- (d) the amino acid sequence encoded by the cDNA insert of clone df396\_1 deposited under accession number ATCC 98369;

the protein being substantially free from other mammalian proteins. Preferably such protein comprises the amino acid sequence of SEQ ID NO:8 or the amino acid sequence of SEQ ID NO:8 from amino acid 1 to amino acid 48.

In one embodiment, the present invention provides a composition comprising an isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:9;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:9 from nucleotide 236 to nucleotide 1213;

- (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:9 from nucleotide 1386 to nucleotide 1833;
- (d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone dh1135\_9 deposited under accession number ATCC 98369;
- (e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone dh1135\_9 deposited under accession number ATCC 98369;
- (f) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone dh1135\_9 deposited under accession number ATCC 98369;
- (g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone dh1135\_9 deposited under accession number ATCC 98369;
- (h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:10;
- (i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:10 having biological activity, the fragment comprising the amino acid sequence from amino acid 157 to amino acid 166 of SEQ ID NO:10;
- (j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;
- (k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and
- (l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).
- Preferably, such polynucleotide comprises the nucleotide sequence of SEQ ID NO:9 from nucleotide 236 to nucleotide 1213; the nucleotide sequence of SEQ ID NO:9 from nucleotide 1386 to nucleotide 1833; the nucleotide sequence of the full-length protein coding sequence of clone dh1135\_9 deposited under accession number ATCC 98369; or the nucleotide sequence of a mature protein coding sequence of clone dh1135\_9 deposited under accession number ATCC 98369. In other preferred embodiments, the polynucleotide encodes the full-length or a mature protein encoded by the cDNA insert of clone dh1135\_9 deposited under accession number ATCC 98369. In yet other preferred embodiments, the present invention provides a polynucleotide encoding a protein

comprising the amino acid sequence of SEQ ID NO:31 from amino acid 1 to amino acid 147.

Other embodiments provide the gene corresponding to the cDNA sequence of SEQ ID NO:9.

5 In other embodiments, the present invention provides a composition comprising a protein, wherein said protein comprises an amino acid sequence selected from the group consisting of:

- (a) the amino acid sequence of SEQ ID NO:10;
  - (b) the amino acid sequence of SEQ ID NO:31 from amino acid 1 to  
10 amino acid 147;
  - (c) fragments of the amino acid sequence of SEQ ID NO:10 comprising the amino acid sequence from amino acid 157 to amino acid 166 of SEQ ID NO:10; and
  - (d) the amino acid sequence encoded by the cDNA insert of clone  
15 dh1135\_9 deposited under accession number ATCC 98369;
- the protein being substantially free from other mammalian proteins. Preferably such protein comprises the amino acid sequence of SEQ ID NO:10 or the amino acid sequence of SEQ ID NO:31 from amino acid 1 to amino acid 147.

In one embodiment, the present invention provides a composition comprising an  
20 isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:11;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:11 from nucleotide 334 to nucleotide 675;
- 25 (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:11 from nucleotide 409 to nucleotide 675;
- (d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone dn809\_5 deposited under accession number ATCC 98369;
- 30 (e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone dn809\_5 deposited under accession number ATCC 98369;
- (f) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone dn809\_5 deposited under accession number ATCC 98369;

(g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone dn809\_5 deposited under accession number ATCC 98369;

(h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:12;

5 (i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:12 having biological activity, the fragment comprising the amino acid sequence from amino acid 52 to amino acid 61 of SEQ ID NO:12;

(j) a polynucleotide which is an allelic variant of a polynucleotide of  
10 (a)-(g) above;

(k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and

(l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).

15 Preferably, such polynucleotide comprises the nucleotide sequence of SEQ ID NO:11 from nucleotide 334 to nucleotide 675; the nucleotide sequence of SEQ ID NO:11 from nucleotide 409 to nucleotide 675; the nucleotide sequence of the full-length protein coding sequence of clone dn809\_5 deposited under accession number ATCC 98369; or the nucleotide sequence of a mature protein coding sequence of clone dn809\_5 deposited  
20 under accession number ATCC 98369. In other preferred embodiments, the polynucleotide encodes the full-length or a mature protein encoded by the cDNA insert of clone dn809\_5 deposited under accession number ATCC 98369. In yet other preferred embodiments, the present invention provides a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:12 from amino acid 1 to amino acid  
25 110.

Other embodiments provide the gene corresponding to the cDNA sequence of SEQ ID NO:11.

In other embodiments, the present invention provides a composition comprising a protein, wherein said protein comprises an amino acid sequence selected from the group  
30 consisting of:

(a) the amino acid sequence of SEQ ID NO:12;

(b) the amino acid sequence of SEQ ID NO:12 from amino acid 1 to amino acid 110;

(c) fragments of the amino acid sequence of SEQ ID NO:12 comprising the amino acid sequence from amino acid 52 to amino acid 61 of SEQ ID NO:12; and

5 (d) the amino acid sequence encoded by the cDNA insert of clone dn809\_5 deposited under accession number ATCC 98369; the protein being substantially free from other mammalian proteins. Preferably such protein comprises the amino acid sequence of SEQ ID NO:12 or the amino acid sequence of SEQ ID NO:12 from amino acid 1 to amino acid 110.

In one embodiment, the present invention provides a composition comprising an  
10 isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:13;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:13 from nucleotide 447 to nucleotide 791;
- 15 (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:13 from nucleotide 597 to nucleotide 791;
- (d) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:13 from nucleotide 1 to nucleotide 546;
- (e) a polynucleotide comprising the nucleotide sequence of the full-  
20 length protein coding sequence of clone ej224\_1 deposited under accession number ATCC 98369;
- (f) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone ej224\_1 deposited under accession number ATCC 98369;
- (g) a polynucleotide comprising the nucleotide sequence of a mature  
25 protein coding sequence of clone ej224\_1 deposited under accession number ATCC 98369;
- (h) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone ej224\_1 deposited under accession number ATCC 98369;
- (i) a polynucleotide encoding a protein comprising the amino acid  
30 sequence of SEQ ID NO:14;
- (j) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:14 having biological activity, the fragment comprising the amino acid sequence from amino acid 52 to amino acid 61 of SEQ ID NO:14;

(k) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(h) above;

(l) a polynucleotide which encodes a species homologue of the protein of (i) or (j) above ; and

5 (m) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(j).

Preferably, such polynucleotide comprises the nucleotide sequence of SEQ ID NO:13 from nucleotide 447 to nucleotide 791; the nucleotide sequence of SEQ ID NO:13 from nucleotide 597 to nucleotide 791; the nucleotide sequence of SEQ ID NO:13 from  
10 nucleotide 1 to nucleotide 546; the nucleotide sequence of the full-length protein coding sequence of clone ej224\_1 deposited under accession number ATCC 98369; or the nucleotide sequence of a mature protein coding sequence of clone ej224\_1 deposited under accession number ATCC 98369. In other preferred embodiments, the polynucleotide encodes the full-length or a mature protein encoded by the cDNA insert of clone ej224\_1  
15 deposited under accession number ATCC 98369. In yet other preferred embodiments, the present invention provides a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:14 from amino acid 82 to amino acid 100.

Other embodiments provide the gene corresponding to the cDNA sequence of SEQ ID NO:13.

20 In other embodiments, the present invention provides a composition comprising a protein, wherein said protein comprises an amino acid sequence selected from the group consisting of:

- (a) the amino acid sequence of SEQ ID NO:14;
- (b) the amino acid sequence of SEQ ID NO:14 from amino acid 82 to  
25 amino acid 100;
- (c) fragments of the amino acid sequence of SEQ ID NO:14 comprising the amino acid sequence from amino acid 52 to amino acid 61 of SEQ ID NO:14; and
- (d) the amino acid sequence encoded by the cDNA insert of clone  
30 ej224\_1 deposited under accession number ATCC 98369;

the protein being substantially free from other mammalian proteins. Preferably such protein comprises the amino acid sequence of SEQ ID NO:14 or the amino acid sequence of SEQ ID NO:14 from amino acid 82 to amino acid 100.

In one embodiment, the present invention provides a composition comprising an isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:15;
- 5 (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:15 from nucleotide 18 to nucleotide 347;
- (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:15 from nucleotide 1 to nucleotide 345;
- (d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone ek591\_1 deposited under accession number ATCC 98369;
- 10 (e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone ek591\_1 deposited under accession number ATCC 98369;
- (f) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone ek591\_1 deposited under accession number ATCC 98369;
- 15 (g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone ek591\_1 deposited under accession number ATCC 98369;
- (h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:16;
- 20 (i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:16 having biological activity, the fragment comprising the amino acid sequence from amino acid 50 to amino acid 59 of SEQ ID NO:16;
- (j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;
- 25 (k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and
- (l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).
- 30

Preferably, such polynucleotide comprises the nucleotide sequence of SEQ ID NO:15 from nucleotide 18 to nucleotide 347; the nucleotide sequence of SEQ ID NO:15 from nucleotide 1 to nucleotide 345; the nucleotide sequence of the full-length protein coding sequence of clone ek591\_1 deposited under accession number ATCC 98369; or the



nucleotide sequence of a mature protein coding sequence of clone ek591\_1 deposited under accession number ATCC 98369. In other preferred embodiments, the polynucleotide encodes the full-length or a mature protein encoded by the cDNA insert of clone ek591\_1 deposited under accession number ATCC 98369. In yet other preferred  
5       embodiments, the present invention provides a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:16 from amino acid 1 to amino acid 109.

Other embodiments provide the gene corresponding to the cDNA sequence of SEQ ID NO:15.

10       In other embodiments, the present invention provides a composition comprising a protein, wherein said protein comprises an amino acid sequence selected from the group consisting of:

- (a) the amino acid sequence of SEQ ID NO:16;
- (b) the amino acid sequence of SEQ ID NO:16 from amino acid 1 to  
15       amino acid 109;
- (c) fragments of the amino acid sequence of SEQ ID NO:16 comprising the amino acid sequence from amino acid 50 to amino acid 59 of SEQ ID NO:16; and
- (d) the amino acid sequence encoded by the cDNA insert of clone  
20       ek591\_1 deposited under accession number ATCC 98369;

the protein being substantially free from other mammalian proteins. Preferably such protein comprises the amino acid sequence of SEQ ID NO:16 or the amino acid sequence of SEQ ID NO:16 from amino acid 1 to amino acid 109.

In one embodiment, the present invention provides a composition comprising an  
25       isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:17;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:17 from nucleotide 593 to nucleotide 1663;
- 30       (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:17 from nucleotide 833 to nucleotide 1663;
- (d) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:17 from nucleotide 648 to nucleotide 1063;

(e) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone er381\_1 deposited under accession number ATCC 98369;

5 (f) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone er381\_1 deposited under accession number ATCC 98369;

(g) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone er381\_1 deposited under accession number ATCC 98369;

10 (h) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone er381\_1 deposited under accession number ATCC 98369;

(i) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:18;

15 (j) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:18 having biological activity, the fragment comprising the amino acid sequence from amino acid 173 to amino acid 182 of SEQ ID NO:18;

(k) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(h) above;

20 (l) a polynucleotide which encodes a species homologue of the protein of (i) or (j) above ; and

(m) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(j).

Preferably, such polynucleotide comprises the nucleotide sequence of SEQ ID NO:17 from nucleotide 593 to nucleotide 1663; the nucleotide sequence of SEQ ID NO:17 from nucleotide 833 to nucleotide 1663; the nucleotide sequence of SEQ ID NO:17 from nucleotide 648 to nucleotide 1063; the nucleotide sequence of the full-length protein coding sequence of clone er381\_1 deposited under accession number ATCC 98369; or the nucleotide sequence of a mature protein coding sequence of clone er381\_1 deposited under accession number ATCC 98369. In other preferred embodiments, the polynucleotide encodes the full-length or a mature protein encoded by the cDNA insert of clone er381\_1 deposited under accession number ATCC 98369. In yet other preferred embodiments, the present invention provides a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:18 from amino acid 20 to amino acid 157.

Other embodiments provide the gene corresponding to the cDNA sequence of SEQ ID NO:17.

In other embodiments, the present invention provides a composition comprising a protein, wherein said protein comprises an amino acid sequence selected from the group

5 consisting of:

- (a) the amino acid sequence of SEQ ID NO:18;
- (b) the amino acid sequence of SEQ ID NO:18 from amino acid 20 to amino acid 157;
- (c) fragments of the amino acid sequence of SEQ ID NO:18 comprising  
10 the amino acid sequence from amino acid 173 to amino acid 182 of SEQ ID NO:18;  
and
- (d) the amino acid sequence encoded by the cDNA insert of clone er381\_1 deposited under accession number ATCC 98369;

the protein being substantially free from other mammalian proteins. Preferably such  
15 protein comprises the amino acid sequence of SEQ ID NO:18 or the amino acid sequence of SEQ ID NO:18 from amino acid 20 to amino acid 157.

In one embodiment, the present invention provides a composition comprising an isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID  
20 NO:19;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:19 from nucleotide 1055 to nucleotide 1246;
- (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:19 from nucleotide 759 to nucleotide 1152;
- (d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone gq38\_1 deposited under accession number ATCC 98369;
- (e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone gq38\_1 deposited under accession number ATCC 98369;
- (f) a polynucleotide comprising the nucleotide sequence of a mature  
30 protein coding sequence of clone gq38\_1 deposited under accession number ATCC 98369;
- (g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone gq38\_1 deposited under accession number ATCC 98369;

(h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:20;

(i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:20 having biological activity, the fragment comprising the amino acid sequence from amino acid 20 to amino acid 29 of SEQ ID NO:20;

(j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;

(k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and

(l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).

Preferably, such polynucleotide comprises the nucleotide sequence of SEQ ID NO:19 from nucleotide 1055 to nucleotide 1246; the nucleotide sequence of SEQ ID NO:19 from nucleotide 759 to nucleotide 1152; the nucleotide sequence of the full-length protein coding sequence of clone gq38\_1 deposited under accession number ATCC 98369; or the nucleotide sequence of a mature protein coding sequence of clone gq38\_1 deposited under accession number ATCC 98369. In other preferred embodiments, the polynucleotide encodes the full-length or a mature protein encoded by the cDNA insert of clone gq38\_1 deposited under accession number ATCC 98369. In yet other preferred embodiments, the present invention provides a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:20 from amino acid 1 to amino acid 32.

Other embodiments provide the gene corresponding to the cDNA sequence of SEQ ID NO:19.

In other embodiments, the present invention provides a composition comprising a protein, wherein said protein comprises an amino acid sequence selected from the group consisting of:

(a) the amino acid sequence of SEQ ID NO:20;

(b) the amino acid sequence of SEQ ID NO:20 from amino acid 1 to amino acid 32;

(c) fragments of the amino acid sequence of SEQ ID NO:20 comprising the amino acid sequence from amino acid 20 to amino acid 29 of SEQ ID NO:20; and

(d) the amino acid sequence encoded by the cDNA insert of clone gq38\_1 deposited under accession number ATCC 98369;

the protein being substantially free from other mammalian proteins. Preferably such protein comprises the amino acid sequence of SEQ ID NO:20 or the amino acid sequence of SEQ ID NO:20 from amino acid 1 to amino acid 32.

In certain preferred embodiments, the polynucleotide is operably linked to an expression control sequence. The invention also provides a host cell, including bacterial, yeast, insect and mammalian cells, transformed with such polynucleotide compositions. Also provided by the present invention are organisms that have enhanced, reduced, or modified expression of the gene(s) corresponding to the polynucleotide sequences disclosed herein.

Processes are also provided for producing a protein, which comprise:

- (a) growing a culture of the host cell transformed with such polynucleotide compositions in a suitable culture medium; and
- (b) purifying the protein from the culture.

The protein produced according to such methods is also provided by the present invention. Preferred embodiments include those in which the protein produced by such process is a mature form of the protein.

Protein compositions of the present invention may further comprise a pharmaceutically acceptable carrier. Compositions comprising an antibody which specifically reacts with such protein are also provided by the present invention.

Methods are also provided for preventing, treating or ameliorating a medical condition which comprises administering to a mammalian subject a therapeutically effective amount of a composition comprising a protein of the present invention and a pharmaceutically acceptable carrier.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1A and 1B are schematic representations of the pED6 and pNOTs vectors, respectively, used for deposit of clones disclosed herein.

#### DETAILED DESCRIPTION

##### ISOLATED PROTEINS AND POLYNUCLEOTIDES

Nucleotide and amino acid sequences, as presently determined, are reported below for each clone and protein disclosed in the present application. The nucleotide

sequence of each clone can readily be determined by sequencing of the deposited clone in accordance with known methods. The predicted amino acid sequence (both full-length and mature forms) can then be determined from such nucleotide sequence. The amino acid sequence of the protein encoded by a particular clone can also be determined by  
5 expression of the clone in a suitable host cell, collecting the protein and determining its sequence. For each disclosed protein applicants have identified what they have determined to be the reading frame best identifiable with sequence information available at the time of filing.

As used herein a "secreted" protein is one which, when expressed in a suitable host  
10 cell, is transported across or through a membrane, including transport as a result of signal sequences in its amino acid sequence. "Secreted" proteins include without limitation proteins secreted wholly (e.g., soluble proteins) or partially (e.g., receptors) from the cell in which they are expressed. "Secreted" proteins also include without limitation proteins which are transported across the membrane of the endoplasmic reticulum.

15

#### Clone "bp783\_3"

A polynucleotide of the present invention has been identified as clone "bp783\_3". bp783\_3 was isolated from a human fetal kidney cDNA library using methods which are selective for cDNAs encoding secreted proteins (see U.S. Pat. No. 5,536,637), or was  
20 identified as encoding a secreted or transmembrane protein on the basis of computer analysis of the amino acid sequence of the encoded protein. bp783\_3 is a full-length clone, including the entire coding sequence of a secreted protein (also referred to herein as "bp783\_3 protein").

The nucleotide sequence of bp783\_3 as presently determined is reported in SEQ  
25 ID NO:1. What applicants presently believe to be the proper reading frame and the predicted amino acid sequence of the bp783\_3 protein corresponding to the foregoing nucleotide sequence is reported in SEQ ID NO:2.

The EcoRI/NotI restriction fragment obtainable from the deposit containing clone bp783\_3 should be approximately 2300 bp.

30 The nucleotide sequence disclosed herein for bp783\_3 was searched against the GenBank and GeneSeq nucleotide sequence databases using BLASTN/BLASTX and FASTA search protocols. bp783\_3 demonstrated at least some similarity with sequences identified as AA099506 (zm17b06.r1 Stratagene pancreas (#937208) Homo sapiens cDNA clone 525875 5'), AA703257 (zi70f10.s1 Soares fetal liver spleen 1NFLS S1 Homo sapiens

cDNA clone 436171 3'), N33318 (yy08a03.s1 Homo sapiens cDNA clone 270604 3'), N35074 (yy19b06.s1 Homo sapiens cDNA clone 271667 3'), and W29359 (mb96f10.r1 Soares mouse p3NMF19.5 Mus musculus cDNA clone 337291 5'). Based upon sequence similarity, bp783\_3 proteins and each similar protein or peptide may share at least some activity.

- 5 The nucleotide sequence of bp783\_3 indicates that it may contain a GAAA repeat sequence.

#### Clone "bu45\_2"

A polynucleotide of the present invention has been identified as clone "bu45\_2".

- 10 bu45\_2 was isolated from a human adult placenta cDNA library using methods which are selective for cDNAs encoding secreted proteins (see U.S. Pat. No. 5,536,637), or was identified as encoding a secreted or transmembrane protein on the basis of computer analysis of the amino acid sequence of the encoded protein. bu45\_2 is a full-length clone, including the entire coding sequence of a secreted protein (also referred to herein as  
15 "bu45\_2 protein").

- The nucleotide sequence of bu45\_2 as presently determined is reported in SEQ ID NO:3. What applicants presently believe to be the proper reading frame and the predicted amino acid sequence of the bu45\_2 protein corresponding to the foregoing nucleotide sequence is reported in SEQ ID NO:4. Amino acids 12 to 24 are a predicted leader/signal  
20 sequence, with the predicted mature amino acid sequence beginning at amino acid 25, or are a transmembrane domain.

The EcoRI/NotI restriction fragment obtainable from the deposit containing clone bu45\_2 should be approximately 1850 bp.

- The nucleotide sequence disclosed herein for bu45\_2 was searched against the  
25 GenBank and GeneSeq nucleotide sequence databases using BLASTN/BLASTX and FASTA search protocols. bu45\_2 demonstrated at least some similarity with sequences identified as AA041196 (zf09e05.s1 Soares fetal heart NbHH19W Homo sapiens cDNA clone 376448 3'), AA452391 (zx29c10.r1 Soares total fetus Nb2HF8 9w Homo sapiens cDNA clone 787890 5'), Q61260 (Human brain Expressed Sequence Tag EST01280), R13864  
30 (yf65e05.r1 Homo sapiens cDNA clone 27004 5'), and R18560 (yf95b10.r1 Homo sapiens cDNA clone 30142 5). The predicted amino acid sequence disclosed herein for bu45\_2 was searched against the GenPept and GeneSeq amino acid sequence databases using the BLASTX search protocol. The predicted bu45\_2 protein demonstrated at least some similarity to sequences identified as R99416 (Aminopeptidase precursor of Aeromonas

caviae). Based upon sequence similarity, bu45\_2 proteins and each similar protein or peptide may share at least some activity. The TopPredII computer program predicts three additional potential transmembrane domains within the bu45\_2 protein sequence, centered around amino acids 137, 205, and 456 of SEQ ID NO:4, respectively.

5

Clone "ct864\_4"

A polynucleotide of the present invention has been identified as clone "ct864\_4". ct864\_4 was isolated from a human adult brain cDNA library using methods which are selective for cDNAs encoding secreted proteins (see U.S. Pat. No. 5,536,637), or was  
10 identified as encoding a secreted or transmembrane protein on the basis of computer analysis of the amino acid sequence of the encoded protein. ct864\_4 is a full-length clone, including the entire coding sequence of a secreted protein (also referred to herein as "ct864\_4 protein").

The nucleotide sequence of ct864\_4 as presently determined is reported in SEQ ID  
15 NO:5. What applicants presently believe to be the proper reading frame and the predicted amino acid sequence of the ct864\_4 protein corresponding to the foregoing nucleotide sequence is reported in SEQ ID NO:6. Amino acids 8 to 20 are a predicted leader/signal sequence, with the predicted mature amino acid sequence beginning at amino acid 21, or are a transmembrane domain.

20 The EcoRI/NotI restriction fragment obtainable from the deposit containing clone ct864\_4 should be approximately 1150 bp.

The nucleotide sequence disclosed herein for ct864\_4 was searched against the GenBank and GeneSeq nucleotide sequence databases using BLASTN/BLASTX and FASTA search protocols. ct864\_4 demonstrated at least some similarity with sequences  
25 identified as AA725566 (ai24d02.s1 Soares testis NHT Homo sapiens cDNA clone 1343715 3' similar to TR Q99795 Q99795 A33 ANTIGEN PRECURSOR), N90730 (za90e09.s1 Soares fetal lung NbHL19W Homo sapiens cDNA clone 299848 3'), T89217 (ye12c02.r1 Homo sapiens cDNA clone 117506 5'), and W80145 (me91g01.r1 Soares mouse embryo NbME13.5 14.5 Mus musculus cDNA clone 402960 5'). The predicted amino acid sequence  
30 disclosed herein for ct864\_4 was searched against the GenPept and GeneSeq amino acid sequence databases using the BLASTX search protocol. The predicted ct864\_4 protein demonstrated at least some similarity to sequences identified as U79725 (A33 antigen precursor [Homo sapiens]). A33 antigen precursor is a transmembrane protein and a member of the immunoglobulin superfamily (Heath *et al.*, 1997, *Proc. Natl. Acad. Sci. USA*



94: 469-474). Based upon sequence similarity, ct864\_4 proteins and each similar protein or peptide may share at least some activity. The TopPredII computer program predicts a potential transmembrane domains within the ct864\_4 protein sequence centered around amino acid 247 of SEQ ID NO:6.

5

Clone "df396\_1"

A polynucleotide of the present invention has been identified as clone "df396\_1". df396\_1 was isolated from a human adult brain cDNA library using methods which are selective for cDNAs encoding secreted proteins (see U.S. Pat. No. 5,536,637), or was  
10 identified as encoding a secreted or transmembrane protein on the basis of computer analysis of the amino acid sequence of the encoded protein. df396\_1 is a full-length clone, including the entire coding sequence of a secreted protein (also referred to herein as "df396\_1 protein").

The nucleotide sequence of df396\_1 as presently determined is reported in SEQ ID  
15 NO:7. What applicants presently believe to be the proper reading frame and the predicted amino acid sequence of the df396\_1 protein corresponding to the foregoing nucleotide sequence is reported in SEQ ID NO:8.

The EcoRI/NotI restriction fragment obtainable from the deposit containing clone df396\_1 should be approximately 2500 bp.

20 The nucleotide sequence disclosed herein for df396\_1 was searched against the GenBank and GeneSeq nucleotide sequence databases using BLASTN/BLASTX and FASTA search protocols. df396\_1 demonstrated at least some similarity with sequences identified as T69764 (yd14c05.s1 Homo sapiens cDNA clone 108200 3') and Z80897 (Human DNA sequence from cosmid E132D12 on chromosome 22q12-qter). Based upon  
25 sequence similarity, df396\_1 proteins and each similar protein or peptide may share at least some activity. The TopPredII computer program predicts two potential transmembrane domains within the df396\_1 protein sequence, centered around amino acids 40 and 80 of SEQ ID NO:8, respectively.

30 Clone "dh1135\_9"

A polynucleotide of the present invention has been identified as clone "dh1135\_9". dh1135\_9 was isolated from a human fetal brain cDNA library using methods which are selective for cDNAs encoding secreted proteins (see U.S. Pat. No. 5,536,637), or was identified as encoding a secreted or transmembrane protein on the basis of computer

analysis of the amino acid sequence of the encoded protein. dh1135\_9 is a full-length clone, including the entire coding sequence of a secreted protein (also referred to herein as "dh1135\_9 protein").

The nucleotide sequence of dh1135\_9 as presently determined is reported in SEQ ID NO:9. What applicants presently believe to be the proper reading frame and the predicted amino acid sequence of the dh1135\_9 protein corresponding to the foregoing nucleotide sequence is reported in SEQ ID NO:10. Another potential dh1135\_9 reading frame and predicted amino acid sequence is encoded by basepairs 1394 to 1879 of SEQ ID NO:9 and is reported in SEQ ID NO:31. Amino acids 84 to 96 of SEQ ID NO:31 are a predicted leader/signal sequence, with the predicted mature amino acid sequence beginning at amino acid 97, or are a transmembrane domain. The open reading frames of SEQ ID NO:10 and SEQ ID NO:31 could be joined if one or more frameshifts were introduced into the nucleotide sequence of SEQ ID NO:9 between basepairs 1000 and 1400.

The EcoRI/NotI restriction fragment obtainable from the deposit containing clone dh1135\_9 should be approximately 2000 bp.

The nucleotide sequence disclosed herein for dh1135\_9 was searched against the GenBank and GeneSeq nucleotide sequence databases using BLASTN/BLASTX and FASTA search protocols. dh1135\_9 demonstrated at least some similarity with sequences identified as AA102652 (zn73b01.s1 Stratagene NT2 neuronal precursor 937230 Homo sapiens cDNA clone 563785 3'), AA207179 (zq73b05.r1 Stratagene neuroepithelium (#937231) Homo sapiens cDNA clone 647217 5'), AA233641 (zr43f02.r1 Soares NhHMPu S1 Homo sapiens cDNA clone 666171 5' similar to TR:G1109804 G1109804 CODED FOR BY C. ELEGANS CDNA CEESW58F), AA238618 (my33e04.r1 Barstead mouse pooled organs MPLRB4 Mus musculus cDNA clone 697662 5'), AA588137 (nm99a06.s1 NCI\_CGAP\_Co9 Homo sapiens cDNA clone IMAGE:1076338), W40329 (zc81c12.r1 Pancreatic Islet Homo sapiens cDNA clone 328726 5'), and W45396 (zc81c12.s1 Pancreatic Islet Homo sapiens cDNA clone 328726 3'). The predicted amino acid sequence disclosed herein for dh1135\_9 was searched against the GenPept and GeneSeq amino acid sequence databases using the BLASTX search protocol. The predicted dh1135\_9 protein demonstrated at least some similarity to sequences identified as U41531 (coded for by C. elegans cDNA CEESW58F [Caenorhabditis elegans]). Based upon sequence similarity, dh1135\_9 proteins and each similar protein or peptide may share at least some activity. The TopPredII computer program predicts two potential transmembrane domains within

the dh1135\_9 protein sequence of SEQ ID NO:10, one around amino acid 50 and another around amino acid 280 of SEQ ID NO:10.

Clone "dn809\_5"

5 A polynucleotide of the present invention has been identified as clone "dn809\_5". dn809\_5 was isolated from a human fetal brain cDNA library using methods which are selective for cDNAs encoding secreted proteins (see U.S. Pat. No. 5,536,637), or was identified as encoding a secreted or transmembrane protein on the basis of computer analysis of the amino acid sequence of the encoded protein. dn809\_5 is a full-length clone,  
10 including the entire coding sequence of a secreted protein (also referred to herein as "dn809\_5 protein").

The nucleotide sequence of dn809\_5 as presently determined is reported in SEQ ID NO:11. What applicants presently believe to be the proper reading frame and the predicted amino acid sequence of the dn809\_5 protein corresponding to the foregoing  
15 nucleotide sequence is reported in SEQ ID NO:12. Amino acids 13 to 25 are a predicted leader/signal sequence, with the predicted mature amino acid sequence beginning at amino acid 26, or are a transmembrane domain.

The EcoRI/NotI restriction fragment obtainable from the deposit containing clone dn809\_5 should be approximately 1000 bp.

20 The nucleotide sequence disclosed herein for dn809\_5 was searched against the GenBank and GeneSeq nucleotide sequence databases using BLASTN/BLASTX and FASTA search protocols. dn809\_5 demonstrated at least some similarity with sequences identified as AA252421 (zs13a07.r1 NCI\_CGAP\_GCB1 Homo sapiens cDNA clone 685044 5'), AA400027 (zu68f11.r1 Soares testis NHT Homo sapiens cDNA clone 743181 5' similar  
25 to contains element MSR1 repetitive element), T79197 (yd70f07.s1 Homo sapiens cDNA clone 113605 3'), and T79284 (yd70f07.r1 Homo sapiens cDNA clone 113605 5'). Based upon sequence similarity, dn809\_5 proteins and each similar protein or peptide may share at least some activity.

30 Clone "ej224\_1"

A polynucleotide of the present invention has been identified as clone "ej224\_1". ej224\_1 was isolated from a human adult placenta cDNA library using methods which are selective for cDNAs encoding secreted proteins (see U.S. Pat. No. 5,536,637), or was identified as encoding a secreted or transmembrane protein on the basis of computer

analysis of the amino acid sequence of the encoded protein. ej224\_1 is a full-length clone, including the entire coding sequence of a secreted protein (also referred to herein as "ej224\_1 protein").

The nucleotide sequence of ej224\_1 as presently determined is reported in SEQ ID NO:13. What applicants presently believe to be the proper reading frame and the predicted amino acid sequence of the ej224\_1 protein corresponding to the foregoing nucleotide sequence is reported in SEQ ID NO:14. Amino acids 38 to 50 are a predicted leader/signal sequence, with the predicted mature amino acid sequence beginning at amino acid 51, or are a transmembrane domain.

The EcoRI/NotI restriction fragment obtainable from the deposit containing clone ej224\_1 should be approximately 2300 bp.

The nucleotide sequence disclosed herein for ej224\_1 was searched against the GenBank and GeneSeq nucleotide sequence databases using BLASTN/BLASTX and FASTA search protocols. ej224\_1 demonstrated at least some similarity with sequences identified as H79156 (yu47a04.r1 Homo sapiens cDNA clone 229230 5' similar to contains Alu repetitive element), M87922 (Human carcinoma cell-derived Alu RNA transcript, clone CD139), and N64587 (yz51h09.s1 Homo sapiens cDNA clone 286625 3' similar to contains Alu repetitive element). Based upon sequence similarity, ej224\_1 proteins and each similar protein or peptide may share at least some activity. The nucleotide sequence of ej224\_1 indicates that it may contain an Alu repetitive element.

#### Clone "ek591\_1"

A polynucleotide of the present invention has been identified as clone "ek591\_1". ek591\_1 was isolated from a human fetal brain cDNA library using methods which are selective for cDNAs encoding secreted proteins (see U.S. Pat. No. 5,536,637), or was identified as encoding a secreted or transmembrane protein on the basis of computer analysis of the amino acid sequence of the encoded protein. ek591\_1 is a full-length clone, including the entire coding sequence of a secreted protein (also referred to herein as "ek591\_1 protein").

The nucleotide sequence of ek591\_1 as presently determined is reported in SEQ ID NO:15. What applicants presently believe to be the proper reading frame and the predicted amino acid sequence of the ek591\_1 protein corresponding to the foregoing nucleotide sequence is reported in SEQ ID NO:16. Another potential ek591\_1 reading frame and predicted amino acid sequence is encoded by basepairs 351 to 599 of SEQ ID

NO:15 and is reported in SEQ ID NO:32; the TopPredII computer program predicts a potential transmembrane domain within the SEQ ID NO:32 amino acid sequence. If the stop codon at basepairs 348-350 of SEQ ID NO:15 were altered to encode an amino acid, the open reading frame of SEQ ID NO:16 would be joined to that of SEQ ID NO:32.

5           The EcoRI/NotI restriction fragment obtainable from the deposit containing clone ek591\_1 should be approximately 1300 bp.

          The nucleotide sequence disclosed herein for ek591\_1 was searched against the GenBank and GeneSeq nucleotide sequence databases using BLASTN/BLASTX and FASTA search protocols. ek591\_1 demonstrated at least some similarity with sequences  
10 identified as AA149073 (zl45d10.r1 Soares pregnant uterus NbHPU Homo sapiens cDNA clone 504883 5' similar to TR G1230697 G1230697 CHROMOSOME XVI COSMID 9513), AA149074 (zl45d10.s1 Soares pregnant uterus NbHPU Homo sapiens cDNA clone 504883 3'), U51033 (Saccharomyces cerevisiae chromosome XVI cosmid 9513), and W31137 (zb45g03.r1 Soares fetal lung NbHL19W Homo sapiens cDNA clone 306580 5'). The  
15 predicted amino acid sequence disclosed herein for ek591\_1 was searched against the GenPept and GeneSeq amino acid sequence databases using the BLASTX search protocol. The predicted ek591\_1 protein demonstrated at least some similarity to sequences identified as U51033 (P9513.2 gene product [Saccharomyces cerevisiae]). Based upon sequence similarity, ek591\_1 proteins and each similar protein or peptide may share at  
20 least some activity. The nucleotide sequence of ek591\_1 indicates that it may contain repetitive elements.

#### Clone "er381\_1"

          A polynucleotide of the present invention has been identified as clone "er381\_1".  
25 er381\_1 was isolated from a human fetal brain cDNA library using methods which are selective for cDNAs encoding secreted proteins (see U.S. Pat. No. 5,536,637), or was identified as encoding a secreted or transmembrane protein on the basis of computer analysis of the amino acid sequence of the encoded protein. er381\_1 is a full-length clone, including the entire coding sequence of a secreted protein (also referred to herein as  
30 "er381\_1 protein").

          The nucleotide sequence of er381\_1 as presently determined is reported in SEQ ID NO:17. What applicants presently believe to be the proper reading frame and the predicted amino acid sequence of the er381\_1 protein corresponding to the foregoing nucleotide sequence is reported in SEQ ID NO:18. Amino acids 68 to 80 are a predicted

leader/signal sequence, with the predicted mature amino acid sequence beginning at amino acid 81, or are a transmembrane domain.

The EcoRI/NotI restriction fragment obtainable from the deposit containing clone er381\_1 should be approximately 2200 bp.

5       The nucleotide sequence disclosed herein for er381\_1 was searched against the GenBank and GeneSeq nucleotide sequence databases using BLASTN/BLASTX and FASTA search protocols. er381\_1 demonstrated at least some similarity with sequences identified as AA043260 (zk49g05.s1 Soares pregnant uterus NbHPU Homo sapiens cDNA clone 486200 3'), AA385070 (EST98667 Thyroid Homo sapiens cDNA 5' end), H28240  
10 (yl60b04.r1 Homo sapiens cDNA clone 162607 5'), H28273 (yl60h04.r1 Homo sapiens cDNA clone 162679 5'), T23745 (Human gene signature HUMGS05632), W29691 (mc07h04.r1 Soares mouse p3NMF19.5 Mus musculus cDNA clone 347863 5'), and  
- W97088 (mf61d08.r1 Soares mouse embryo NbME13.5 14.5 Mus musculus cDNA clone 418767 5'). Based upon sequence similarity, er381\_1 proteins and each similar protein or  
15 peptide may share at least some activity. The TopPredII computer program predicts two potential transmembrane domains within the er381\_1 protein sequence, one around amino acid 200 and another around amino acid 220 of SEQ ID NO:18. The nucleotide sequence of er381\_1 indicates that it may contain a TAR1 repetitive element.

20       Clone "gq38\_1"

A polynucleotide of the present invention has been identified as clone "gq38\_1". gq38\_1 was isolated from a human adult pineal gland cDNA library using methods which are selective for cDNAs encoding secreted proteins (see U.S. Pat. No. 5,536,637), or was identified as encoding a secreted or transmembrane protein on the basis of computer  
25 analysis of the amino acid sequence of the encoded protein. gq38\_1 is a full-length clone, including the entire coding sequence of a secreted protein (also referred to herein as "gq38\_1 protein").

The nucleotide sequence of gq38\_1 as presently determined is reported in SEQ ID NO:19. What applicants presently believe to be the proper reading frame and the  
30 predicted amino acid sequence of the gq38\_1 protein corresponding to the foregoing nucleotide sequence is reported in SEQ ID NO:20.

The EcoRI/NotI restriction fragment obtainable from the deposit containing clone gq38\_1 should be approximately 1500 bp.

The nucleotide sequence disclosed herein for gq38\_1 was searched against the GenBank and GeneSeq nucleotide sequence databases using BLASTN/BLASTX and FASTA search protocols. gq38\_1 demonstrated at least some similarity with sequences identified as AA134939 (zo26b06.s1 Stratagene colon (#937204) Homo sapiens cDNA clone 587987 3'), AA195485 (zp87h08.s1 Stratagene HeLa cell s3 937216 Homo sapiens cDNA clone 627231 3'), AA280722 (zs96e09.r1 NCI\_CGAP\_GCB1 Homo sapiens cDNA clone 711496 5'), H85699 (ys68e04.r1 Homo sapiens cDNA clone 219966 5' similar to contains Alu repetitive element), N98571 (za69g01.r1 Homo sapiens cDNA clone 297840 5'), R81264 (yj01a02.r1 Homo sapiens cDNA clone 147434 5'), and W76442 (zd61b07.r1 Soares fetal heart). Based upon sequence similarity, gq38\_1 proteins and each similar protein or peptide may share at least some activity.

#### Deposit of Clones

Clones bp783\_3, bu45\_2, ct864\_4, df396\_1, dh1135\_9, dn809\_5, ej224\_1, ek591\_1, er381\_1, and gq38\_1 were deposited on March 21, 1997 with the American Type Culture Collection as an original deposit under the Budapest Treaty and were given the accession number ATCC 98369, from which each clone comprising a particular polynucleotide is obtainable. All restrictions on the availability to the public of the deposited material will be irrevocably removed upon the granting of the patent, except for the requirements specified in 37 C.F.R. § 1.808(b).

Each clone has been transfected into separate bacterial cells (*E. coli*) in this composite deposit. Each clone can be removed from the vector in which it was deposited by performing an EcoRI/NotI digestion (5' site, EcoRI; 3' site, NotI) to produce the appropriate fragment for such clone. Each clone was deposited in either the pED6 or pNOTs vector depicted in Fig. 1. The pED6dpc2 vector ("pED6") was derived from pED6dpc1 by insertion of a new polylinker to facilitate cDNA cloning (Kaufman *et al.*, 1991, *Nucleic Acids Res.* 19: 4485-4490); the pNOTs vector was derived from pMT2 (Kaufman *et al.*, 1989, *Mol. Cell. Biol.* 9: 946-958) by deletion of the DHFR sequences, insertion of a new polylinker, and insertion of the M13 origin of replication in the ClaI site. In some instances, the deposited clone can become "flipped" (i.e., in the reverse orientation) in the deposited isolate. In such instances, the cDNA insert can still be isolated by digestion with EcoRI and NotI. However, NotI will then produce the 5' site and EcoRI will produce the 3' site for placement of the cDNA in proper orientation for

expression in a suitable vector. The cDNA may also be expressed from the vectors in which they were deposited.

Bacterial cells containing a particular clone can be obtained from the composite deposit as follows:

- 5           An oligonucleotide probe or probes should be designed to the sequence that is known for that particular clone. This sequence can be derived from the sequences provided herein, or from a combination of those sequences. The sequence of the oligonucleotide probe that was used to isolate each full-length clone is identified below, and should be most reliable in isolating the clone of interest.

10

	<u>Clone</u>	<u>Probe Sequence</u>
	bp783_3	SEQ ID NO:21
	bu45_2	SEQ ID NO:22
	ct864_4	SEQ ID NO:23
15	df396_1	SEQ ID NO:24
	dh1135_9	SEQ ID NO:25
	dn809_5	SEQ ID NO:26
	ej224_1	SEQ ID NO:27
	ek591_1	SEQ ID NO:28
20	er381_1	SEQ ID NO:29
	gq38_1	SEQ ID NO:30

In the sequences listed above which include an N at position 2, that position is occupied in preferred probes/primers by a biotinylated phosphoramidite residue rather than a  
 25 nucleotide (such as , for example, that produced by use of biotin phosphoramidite (1-dimethoxytrityloxy-2-(N-biotinyl-4-aminobutyl)-propyl-3-O-(2-cyanoethyl)-(N,N-diisopropyl)-phosphoramidite) (Glen Research, cat. no. 10-1953)).

The design of the oligonucleotide probe should preferably follow these parameters:

- 30           (a) It should be designed to an area of the sequence which has the fewest ambiguous bases ("N"s"), if any;
- (b) It should be designed to have a  $T_m$  of approx. 80 ° C (assuming 2° for each A or T and 4 degrees for each G or C).



The oligonucleotide should preferably be labeled with  $\gamma$ - $^{32}\text{P}$  ATP (specific activity 6000 Ci/mmol) and T4 polynucleotide kinase using commonly employed techniques for labeling oligonucleotides. Other labeling techniques can also be used. Unincorporated label should preferably be removed by gel filtration chromatography or other established  
5 methods. The amount of radioactivity incorporated into the probe should be quantitated by measurement in a scintillation counter. Preferably, specific activity of the resulting probe should be approximately  $4 \times 10^6$  dpm/pmol.

The bacterial culture containing the pool of full-length clones should preferably be thawed and 100  $\mu\text{L}$  of the stock used to inoculate a sterile culture flask containing 25 ml  
10 of sterile L-broth containing ampicillin at 100  $\mu\text{g}/\text{ml}$ . The culture should preferably be grown to saturation at  $37^\circ\text{C}$ , and the saturated culture should preferably be diluted in fresh L-broth. Aliquots of these dilutions should preferably be plated to determine the dilution and volume which will yield approximately 5000 distinct and well-separated colonies on solid bacteriological media containing L-broth containing ampicillin at 100  
15  $\mu\text{g}/\text{ml}$  and agar at 1.5% in a 150 mm petri dish when grown overnight at  $37^\circ\text{C}$ . Other known methods of obtaining distinct, well-separated colonies can also be employed.

Standard colony hybridization procedures should then be used to transfer the colonies to nitrocellulose filters and lyse, denature and bake them.

The filter is then preferably incubated at  $65^\circ\text{C}$  for 1 hour with gentle agitation in  
20 6X SSC (20X stock is 175.3 g NaCl/liter, 88.2 g Na citrate/liter, adjusted to pH 7.0 with NaOH) containing 0.5% SDS, 100  $\mu\text{g}/\text{ml}$  of yeast RNA, and 10 mM EDTA (approximately 10 mL per 150 mm filter). Preferably, the probe is then added to the hybridization mix at a concentration greater than or equal to  $1 \times 10^6$  dpm/mL. The filter is then preferably incubated at  $65^\circ\text{C}$  with gentle agitation overnight. The filter is then preferably washed in  
25 500 mL of 2X SSC/0.5% SDS at room temperature without agitation, preferably followed by 500 mL of 2X SSC/0.1% SDS at room temperature with gentle shaking for 15 minutes. A third wash with 0.1X SSC/0.5% SDS at  $65^\circ\text{C}$  for 30 minutes to 1 hour is optional. The filter is then preferably dried and subjected to autoradiography for sufficient time to visualize the positives on the X-ray film. Other known hybridization methods can also  
30 be employed.

The positive colonies are picked, grown in culture, and plasmid DNA isolated using standard procedures. The clones can then be verified by restriction analysis, hybridization analysis, or DNA sequencing.

Fragments of the proteins of the present invention which are capable of exhibiting biological activity are also encompassed by the present invention. Fragments of the protein may be in linear form or they may be cyclized using known methods, for example, as described in H.U. Saragovi, *et al.*, Bio/Technology 10, 773-778 (1992) and in R.S. McDowell, *et al.*, J. Amer. Chem. Soc. 114, 9245-9253 (1992), both of which are incorporated herein by reference. Such fragments may be fused to carrier molecules such as immunoglobulins for many purposes, including increasing the valency of protein binding sites. For example, fragments of the protein may be fused through "linker" sequences to the Fc portion of an immunoglobulin. For a bivalent form of the protein, such a fusion could be to the Fc portion of an IgG molecule. Other immunoglobulin isotypes may also be used to generate such fusions. For example, a protein - IgM fusion would generate a decavalent form of the protein of the invention.

The present invention also provides both full-length and mature forms of the disclosed proteins. The full-length form of the such proteins is identified in the sequence listing by translation of the nucleotide sequence of each disclosed clone. The mature form(s) of such protein may be obtained by expression of the disclosed full-length polynucleotide (preferably those deposited with ATCC) in a suitable mammalian cell or other host cell. The sequence(s) of the mature form(s) of the protein may also be determinable from the amino acid sequence of the full-length form.

The present invention also provides genes corresponding to the polynucleotide sequences disclosed herein. "Corresponding genes" are the regions of the genome that are transcribed to produce the mRNAs from which cDNA polynucleotide sequences are derived and may include contiguous regions of the genome necessary for the regulated expression of such genes. Corresponding genes may therefore include but are not limited to coding sequences, 5' and 3' untranslated regions, alternatively spliced exons, introns, promoters, enhancers, and silencer or suppressor elements. The corresponding genes can be isolated in accordance with known methods using the sequence information disclosed herein. Such methods include the preparation of probes or primers from the disclosed sequence information for identification and/or amplification of genes in appropriate genomic libraries or other sources of genomic materials. An "isolated gene" is a gene that has been separated from the adjacent coding sequences, if any, present in the genome of the organism from which the gene was isolated.

Organisms that have enhanced, reduced, or modified expression of the gene(s) corresponding to the polynucleotide sequences disclosed herein are provided. The

desired change in gene expression can be achieved through the use of antisense polynucleotides or ribozymes that bind and/or cleave the mRNA transcribed from the gene (Albert and Morris, 1994, *Trends Pharmacol. Sci.* 15(7): 250-254; Lavarosky *et al.*, 1997, *Biochem. Mol. Med.* 62(1): 11-22; and Hampel, 1998, *Prog. Nucleic Acid Res. Mol. Biol.* 58: 1-39; all of which are incorporated by reference herein). Transgenic animals that have multiple copies of the gene(s) corresponding to the polynucleotide sequences disclosed herein, preferably produced by transformation of cells with genetic constructs that are stably maintained within the transformed cells and their progeny, are provided. Transgenic animals that have modified genetic control regions that increase or reduce gene expression levels, or that change temporal or spatial patterns of gene expression, are also provided (see European Patent No. 0 649 464 B1, incorporated by reference herein). In addition, organisms are provided in which the gene(s) corresponding to the polynucleotide sequences disclosed herein have been partially or completely inactivated, through insertion of extraneous sequences into the corresponding gene(s) or through deletion of all or part of the corresponding gene(s). Partial or complete gene inactivation can be accomplished through insertion, preferably followed by imprecise excision, of transposable elements (Plasterk, 1992, *Bioessays* 14(9): 629-633; Zwaal *et al.*, 1993, *Proc. Natl. Acad. Sci. USA* 90(16): 7431-7435; Clark *et al.*, 1994, *Proc. Natl. Acad. Sci. USA* 91(2): 719-722; all of which are incorporated by reference herein), or through homologous recombination, preferably detected by positive/negative genetic selection strategies (Mansour *et al.*, 1988, *Nature* 336: 348-352; U.S. Patent Nos. 5,464,764; 5,487,992; 5,627,059; 5,631,153; 5,614,396; 5,616,491; and 5,679,523; all of which are incorporated by reference herein). These organisms with altered gene expression are preferably eukaryotes and more preferably are mammals. Such organisms are useful for the development of non-human models for the study of disorders involving the corresponding gene(s), and for the development of assay systems for the identification of molecules that interact with the protein product(s) of the corresponding gene(s).

Where the protein of the present invention is membrane-bound (e.g., is a receptor), the present invention also provides for soluble forms of such protein. In such forms part or all of the intracellular and transmembrane domains of the protein are deleted such that the protein is fully secreted from the cell in which it is expressed. The intracellular and transmembrane domains of proteins of the invention can be identified in accordance with known techniques for determination of such domains from sequence information.

Proteins and protein fragments of the present invention include proteins with amino acid sequence lengths that are at least 25% (more preferably at least 50%, and most preferably at least 75%) of the length of a disclosed protein and have at least 60% sequence identity (more preferably, at least 75% identity; most preferably at least 90% or 95% identity) with that disclosed protein, where sequence identity is determined by comparing the amino acid sequences of the proteins when aligned so as to maximize overlap and identity while minimizing sequence gaps. Also included in the present invention are proteins and protein fragments that contain a segment preferably comprising 8 or more (more preferably 20 or more, most preferably 30 or more) contiguous amino acids that shares at least 75% sequence identity (more preferably, at least 85% identity; most preferably at least 95% identity) with any such segment of any of the disclosed proteins.

Species homologues of the disclosed polynucleotides and proteins are also provided by the present invention. As used herein, a "species homologue" is a protein or polynucleotide with a different species of origin from that of a given protein or polynucleotide, but with significant sequence similarity to the given protein or polynucleotide. Preferably, polynucleotide species homologues have at least 60% sequence identity (more preferably, at least 75% identity; most preferably at least 90% identity) with the given polynucleotide, and protein species homologues have at least 30% sequence identity (more preferably, at least 45% identity; most preferably at least 60% identity) with the given protein, where sequence identity is determined by comparing the nucleotide sequences of the polynucleotides or the amino acid sequences of the proteins when aligned so as to maximize overlap and identity while minimizing sequence gaps. Species homologues may be isolated and identified by making suitable probes or primers from the sequences provided herein and screening a suitable nucleic acid source from the desired species. Preferably, species homologues are those isolated from mammalian species. Most preferably, species homologues are those isolated from certain mammalian species such as, for example, *Pan troglodytes*, *Gorilla gorilla*, *Pongo pygmaeus*, *Hylobates concolor*, *Macaca mulatta*, *Papio papio*, *Papio hamadryas*, *Cercopithecus aethiops*, *Cebus capucinus*, *Aotus trivirgatus*, *Sanguinus oedipus*, *Microcebus murinus*, *Mus musculus*, *Rattus norvegicus*, *Cricetulus griseus*, *Felis catus*, *Mustela vison*, *Canis familiaris*, *Oryctolagus cuniculus*, *Bos taurus*, *Ovis aries*, *Sus scrofa*, and *Equus caballus*, for which genetic maps have been created allowing the identification of syntenic relationships between the genomic organization of genes in one species and the genomic organization of the related genes in another species

(O'Brien and Seuánez, 1988, *Ann. Rev. Genet.* 22: 323-351; O'Brien *et al.*, 1993, *Nature Genetics* 3:103-112; Johansson *et al.*, 1995, *Genomics* 25: 682-690; Lyons *et al.*, 1997, *Nature Genetics* 15: 47-56; O'Brien *et al.*, 1997, *Trends in Genetics* 13(10): 393-399; Carver and Stubbs, 1997, *Genome Research* 7:1123-1137; all of which are incorporated by reference herein).

5           The invention also encompasses allelic variants of the disclosed polynucleotides or proteins; that is, naturally-occurring alternative forms of the isolated polynucleotides which also encode proteins which are identical or have significantly similar sequences to those encoded by the disclosed polynucleotides. Preferably, allelic variants have at least 60% sequence identity (more preferably, at least 75% identity; most preferably at least 90%  
10 identity) with the given polynucleotide, where sequence identity is determined by comparing the nucleotide sequences of the polynucleotides when aligned so as to maximize overlap and identity while minimizing sequence gaps. Allelic variants may be isolated and identified by making suitable probes or primers from the sequences provided herein and screening a suitable nucleic acid source from individuals of the appropriate species.

15           The invention also includes polynucleotides with sequences complementary to those of the polynucleotides disclosed herein.

          The present invention also includes polynucleotides capable of hybridizing under reduced stringency conditions, more preferably stringent conditions, and most preferably highly stringent conditions, to polynucleotides described herein. Examples of stringency  
20 conditions are shown in the table below: highly stringent conditions are those that are at least as stringent as, for example, conditions A-F; stringent conditions are at least as stringent as, for example, conditions G-L; and reduced stringency conditions are at least as stringent as, for example, conditions M-R.

Stringency Condition	Polynucleotide Hybrid	Hybrid Length (bp) <sup>‡</sup>	Hybridization Temperature and Buffer <sup>†</sup>	Wash Temperature and Buffer <sup>†</sup>
5	A	≥ 50	65°C; 1xSSC -or- 42°C; 1xSSC, 50% formamide	65°C; 0.3xSSC
	B	<50	T <sub>B</sub> *; 1xSSC	T <sub>B</sub> *; 1xSSC
	C	≥ 50	67°C; 1xSSC -or- 45°C; 1xSSC, 50% formamide	67°C; 0.3xSSC
	D	<50	T <sub>D</sub> *; 1xSSC	T <sub>D</sub> *; 1xSSC
	E	≥ 50	70°C; 1xSSC -or- 50°C; 1xSSC, 50% formamide	70°C; 0.3xSSC
	F	<50	T <sub>F</sub> *; 1xSSC	T <sub>F</sub> *; 1xSSC
10	G	≥ 50	65°C; 4xSSC -or- 42°C; 4xSSC, 50% formamide	65°C; 1xSSC
	H	<50	T <sub>H</sub> *; 4xSSC	T <sub>H</sub> *; 4xSSC
	I	≥ 50	67°C; 4xSSC -or- 45°C; 4xSSC, 50% formamide	67°C; 1xSSC
	J	<50	T <sub>J</sub> *; 4xSSC	T <sub>J</sub> *; 4xSSC
	K	≥ 50	70°C; 4xSSC -or- 50°C; 4xSSC, 50% formamide	67°C; 1xSSC
	L	<50	T <sub>L</sub> *; 2xSSC	T <sub>L</sub> *; 2xSSC
15	M	≥ 50	50°C; 4xSSC -or- 40°C; 6xSSC, 50% formamide	50°C; 2xSSC
	N	<50	T <sub>N</sub> *; 6xSSC	T <sub>N</sub> *; 6xSSC
	O	≥ 50	55°C; 4xSSC -or- 42°C; 6xSSC, 50% formamide	55°C; 2xSSC
	P	<50	T <sub>P</sub> *; 6xSSC	T <sub>P</sub> *; 6xSSC
	Q	≥ 50	60°C; 4xSSC -or- 45°C; 6xSSC, 50% formamide	60°C; 2xSSC
	R	<50	T <sub>R</sub> *; 4xSSC	T <sub>R</sub> *; 4xSSC

<sup>‡</sup>: The hybrid length is that anticipated for the hybridized region(s) of the hybridizing polynucleotides. When hybridizing a polynucleotide to a target polynucleotide of unknown sequence, the hybrid length is assumed to be that of the hybridizing polynucleotide. When polynucleotides of known sequence are hybridized, the hybrid length can be determined by aligning the sequences of the polynucleotides and identifying the region or regions of optimal sequence complementarity.

<sup>†</sup>: SSPE (1xSSPE is 0.15M NaCl, 10mM NaH<sub>2</sub>PO<sub>4</sub>, and 1.25mM EDTA, pH 7.4) can be substituted for SSC (1xSSC is 0.15M NaCl and 15mM sodium citrate) in the hybridization and wash buffers; washes are performed for 15 minutes after hybridization is complete.

\*T<sub>B</sub> - T<sub>R</sub>: The hybridization temperature for hybrids anticipated to be less than 50 base pairs in length should be 5-10°C less than the melting temperature (T<sub>m</sub>) of the hybrid, where T<sub>m</sub> is determined according to the following equations. For hybrids less than 18 base pairs in length, T<sub>m</sub>(°C) = 2(# of A + T bases) + 4(# of G + C bases). For hybrids between 18 and 49 base pairs in length, T<sub>m</sub>(°C) = 81.5 + 16.6(log<sub>10</sub>[Na<sup>+</sup>]) + 0.41(%G+C) - (600/N), where N is the number of bases in the hybrid, and [Na<sup>+</sup>] is the concentration of sodium ions in the hybridization buffer ([Na<sup>+</sup>] for 1xSSC = 0.165 M).

Additional examples of stringency conditions for polynucleotide hybridization are provided in Sambrook, J., E.F. Fritsch, and T. Maniatis, 1989, *Molecular Cloning: A Laboratory Manual*, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY, chapters 9 and 11, and *Current Protocols in Molecular Biology*, 1995, F.M. Ausubel et al., eds.,  
5 John Wiley & Sons, Inc., sections 2.10 and 6.3-6.4, incorporated herein by reference.

Preferably, each such hybridizing polynucleotide has a length that is at least 25% (more preferably at least 50%, and most preferably at least 75%) of the length of the polynucleotide of the present invention to which it hybridizes, and has at least 60% sequence identity (more preferably, at least 75% identity; most preferably at least 90% or  
10 95% identity) with the polynucleotide of the present invention to which it hybridizes, where sequence identity is determined by comparing the sequences of the hybridizing polynucleotides when aligned so as to maximize overlap and identity while minimizing sequence gaps.

The isolated polynucleotide of the invention may be operably linked to an  
15 expression control sequence such as the pMT2 or pED expression vectors disclosed in Kaufman *et al.*, *Nucleic Acids Res.* 19, 4485-4490 (1991), in order to produce the protein recombinantly. Many suitable expression control sequences are known in the art. General methods of expressing recombinant proteins are also known and are exemplified in R. Kaufman, *Methods in Enzymology* 185, 537-566 (1990). As defined herein "operably  
20 linked" means that the isolated polynucleotide of the invention and an expression control sequence are situated within a vector or cell in such a way that the protein is expressed by a host cell which has been transformed (transfected) with the ligated polynucleotide/expression control sequence.

A number of types of cells may act as suitable host cells for expression of the  
25 protein. Mammalian host cells include, for example, monkey COS cells, Chinese Hamster Ovary (CHO) cells, human kidney 293 cells, human epidermal A431 cells, human Colo205 cells, 3T3 cells, CV-1 cells, other transformed primate cell lines, normal diploid cells, cell strains derived from *in vitro* culture of primary tissue, primary explants, HeLa cells, mouse L cells, BHK, HL-60, U937, HaK or Jurkat cells.

30 Alternatively, it may be possible to produce the protein in lower eukaryotes such as yeast or in prokaryotes such as bacteria. Potentially suitable yeast strains include *Saccharomyces cerevisiae*, *Schizosaccharomyces pombe*, *Kluyveromyces* strains, *Candida*, or any yeast strain capable of expressing heterologous proteins. Potentially suitable bacterial strains include *Escherichia coli*, *Bacillus subtilis*, *Salmonella typhimurium*, or any bacterial

strain capable of expressing heterologous proteins. If the protein is made in yeast or bacteria, it may be necessary to modify the protein produced therein, for example by phosphorylation or glycosylation of the appropriate sites, in order to obtain the functional protein. Such covalent attachments may be accomplished using known chemical or enzymatic methods.

The protein may also be produced by operably linking the isolated polynucleotide of the invention to suitable control sequences in one or more insect expression vectors, and employing an insect expression system. Materials and methods for baculovirus/insect cell expression systems are commercially available in kit form from, e.g., Invitrogen, San Diego, California, U.S.A. (the MaxBac® kit), and such methods are well known in the art, as described in Summers and Smith, Texas Agricultural Experiment Station Bulletin No. 1555 (1987), incorporated herein by reference. As used herein, an insect cell capable of expressing a polynucleotide of the present invention is "transformed."

The protein of the invention may be prepared by culturing transformed host cells under culture conditions suitable to express the recombinant protein. The resulting expressed protein may then be purified from such culture (i.e., from culture medium or cell extracts) using known purification processes, such as gel filtration and ion exchange chromatography. The purification of the protein may also include an affinity column containing agents which will bind to the protein; one or more column steps over such affinity resins as concanavalin A-agarose, heparin-toyopearl® or Cibacrom blue 3GA Sepharose®; one or more steps involving hydrophobic interaction chromatography using such resins as phenyl ether, butyl ether, or propyl ether; or immunoaffinity chromatography.

Alternatively, the protein of the invention may also be expressed in a form which will facilitate purification. For example, it may be expressed as a fusion protein, such as those of maltose binding protein (MBP), glutathione-S-transferase (GST) or thioredoxin (TRX). Kits for expression and purification of such fusion proteins are commercially available from New England BioLab (Beverly, MA), Pharmacia (Piscataway, NJ) and InVitrogen, respectively. The protein can also be tagged with an epitope and subsequently purified by using a specific antibody directed to such epitope. One such epitope ("Flag") is commercially available from Kodak (New Haven, CT).

Finally, one or more reverse-phase high performance liquid chromatography (RP-HPLC) steps employing hydrophobic RP-HPLC media, e.g., silica gel having pendant



methyle or other aliphatic groups, can be employed to further purify the protein. Some or all of the foregoing purification steps, in various combinations, can also be employed to provide a substantially homogeneous isolated recombinant protein. The protein thus purified is substantially free of other mammalian proteins and is defined in accordance  
5 with the present invention as an "isolated protein."

The protein of the invention may also be expressed as a product of transgenic animals, e.g., as a component of the milk of transgenic cows, goats, pigs, or sheep which are characterized by somatic or germ cells containing a nucleotide sequence encoding the protein.

10 The protein may also be produced by known conventional chemical synthesis. Methods for constructing the proteins of the present invention by synthetic means are known to those skilled in the art. The synthetically-constructed protein sequences, by virtue of sharing primary, secondary or tertiary structural and/or conformational characteristics with proteins may possess biological properties in common therewith,  
15 including protein activity. Thus, they may be employed as biologically active or immunological substitutes for natural, purified proteins in screening of therapeutic compounds and in immunological processes for the development of antibodies.

The proteins provided herein also include proteins characterized by amino acid sequences similar to those of purified proteins but into which modification are naturally  
20 provided or deliberately engineered. For example, modifications in the peptide or DNA sequences can be made by those skilled in the art using known techniques. Modifications of interest in the protein sequences may include the alteration, substitution, replacement, insertion or deletion of a selected amino acid residue in the coding sequence. For example, one or more of the cysteine residues may be deleted or replaced with another  
25 amino acid to alter the conformation of the molecule. Techniques for such alteration, substitution, replacement, insertion or deletion are well known to those skilled in the art (see, e.g., U.S. Patent No. 4,518,584). Preferably, such alteration, substitution, replacement, insertion or deletion retains the desired activity of the protein.

Other fragments and derivatives of the sequences of proteins which would be  
30 expected to retain protein activity in whole or in part and may thus be useful for screening or other immunological methodologies may also be easily made by those skilled in the art given the disclosures herein. Such modifications are believed to be encompassed by the present invention.

## USES AND BIOLOGICAL ACTIVITY

The polynucleotides and proteins of the present invention are expected to exhibit one or more of the uses or biological activities (including those associated with assays cited herein) identified below. Uses or activities described for proteins of the present invention may be provided by administration or use of such proteins or by administration or use of polynucleotides encoding such proteins (such as, for example, in gene therapies or vectors suitable for introduction of DNA).

### Research Uses and Utilities

The polynucleotides provided by the present invention can be used by the research community for various purposes. The polynucleotides can be used to express recombinant protein for analysis, characterization or therapeutic use; as markers for tissues in which the corresponding protein is preferentially expressed (either constitutively or at a particular stage of tissue differentiation or development or in disease states); as molecular weight markers on Southern gels; as chromosome markers or tags (when labeled) to identify chromosomes or to map related gene positions; to compare with endogenous DNA sequences in patients to identify potential genetic disorders; as probes to hybridize and thus discover novel, related DNA sequences; as a source of information to derive PCR primers for genetic fingerprinting; as a probe to "subtract-out" known sequences in the process of discovering other novel polynucleotides; for selecting and making oligomers for attachment to a "gene chip" or other support, including for examination of expression patterns; to raise anti-protein antibodies using DNA immunization techniques; and as an antigen to raise anti-DNA antibodies or elicit another immune response. Where the polynucleotide encodes a protein which binds or potentially binds to another protein (such as, for example, in a receptor-ligand interaction), the polynucleotide can also be used in interaction trap assays (such as, for example, that described in Gyuris et al., Cell 75:791-803 (1993)) to identify polynucleotides encoding the other protein with which binding occurs or to identify inhibitors of the binding interaction.

The proteins provided by the present invention can similarly be used in assay to determine biological activity, including in a panel of multiple proteins for high-throughput screening; to raise antibodies or to elicit another immune response; as a reagent (including the labeled reagent) in assays designed to quantitatively determine levels of the protein (or its receptor) in biological fluids; as markers for tissues in which

the corresponding protein is preferentially expressed (either constitutively or at a particular stage of tissue differentiation or development or in a disease state); and, of course, to isolate correlative receptors or ligands. Where the protein binds or potentially binds to another protein (such as, for example, in a receptor-ligand interaction), the protein can be used to identify the other protein with which binding occurs or to identify inhibitors of the binding interaction. Proteins involved in these binding interactions can also be used to screen for peptide or small molecule inhibitors or agonists of the binding interaction.

Any or all of these research utilities are capable of being developed into reagent grade or kit format for commercialization as research products.

Methods for performing the uses listed above are well known to those skilled in the art. References disclosing such methods include without limitation "Molecular Cloning: A Laboratory Manual", 2d ed., Cold Spring Harbor Laboratory Press, Sambrook, J., E.F. Fritsch and T. Maniatis eds., 1989, and "Methods in Enzymology: Guide to Molecular Cloning Techniques", Academic Press, Berger, S.L. and A.R. Kimmel eds., 1987.

#### Nutritional Uses

Polynucleotides and proteins of the present invention can also be used as nutritional sources or supplements. Such uses include without limitation use as a protein or amino acid supplement, use as a carbon source, use as a nitrogen source and use as a source of carbohydrate. In such cases the protein or polynucleotide of the invention can be added to the feed of a particular organism or can be administered as a separate solid or liquid preparation, such as in the form of powder, pills, solutions, suspensions or capsules. In the case of microorganisms, the protein or polynucleotide of the invention can be added to the medium in or on which the microorganism is cultured.

#### Cytokine and Cell Proliferation/Differentiation Activity

A protein of the present invention may exhibit cytokine, cell proliferation (either inducing or inhibiting) or cell differentiation (either inducing or inhibiting) activity or may induce production of other cytokines in certain cell populations. Many protein factors discovered to date, including all known cytokines, have exhibited activity in one or more factor dependent cell proliferation assays, and hence the assays serve as a convenient confirmation of cytokine activity. The activity of a protein of the present invention is evidenced by any one of a number of routine factor dependent cell proliferation assays

for cell lines including, without limitation, 32D, DA2, DA1G, T10, B9, B9/11, BaF3, MC9/G, M+ (preB M+), 2E8, RB5, DA1, 123, T1165, HT2, CTLL2, TF-1, Mo7e and CMK.

The activity of a protein of the invention may, among other means, be measured  
5 by the following methods:

Assays for T-cell or thymocyte proliferation include without limitation those described in: *Current Protocols in Immunology*, Ed by J. E. Coligan, A.M. Kruisbeek, D.H. Margulies, E.M. Shevach, W Strober, Pub. Greene Publishing Associates and Wiley-Interscience (Chapter 3, In Vitro assays for Mouse Lymphocyte Function 3.1-3.19; Chapter  
10 7, Immunologic studies in Humans); Takai et al., *J. Immunol.* 137:3494-3500, 1986; Bertagnolli et al., *J. Immunol.* 145:1706-1712, 1990; Bertagnolli et al., *Cellular Immunology* 133:327-341, 1991; Bertagnolli, et al., *J. Immunol.* 149:3778-3783, 1992; Bowman et al., *J. Immunol.* 152: 1756-1761, 1994.

Assays for cytokine production and/or proliferation of spleen cells, lymph node  
15 cells or thymocytes include, without limitation, those described in: Polyclonal T cell stimulation, Kruisbeek, A.M. and Shevach, E.M. In *Current Protocols in Immunology*. J.E.e.a. Coligan eds. Vol 1 pp. 3.12.1-3.12.14, John Wiley and Sons, Toronto. 1994; and Measurement of mouse and human Interferon  $\gamma$ , Schreiber, R.D. In *Current Protocols in Immunology*. J.E.e.a. Coligan eds. Vol 1 pp. 6.8.1-6.8.8, John Wiley and Sons, Toronto. 1994.

Assays for proliferation and differentiation of hematopoietic and lymphopoietic  
20 cells include, without limitation, those described in: Measurement of Human and Murine Interleukin 2 and Interleukin 4, Bottomly, K., Davis, L.S. and Lipsky, P.E. In *Current Protocols in Immunology*. J.E.e.a. Coligan eds. Vol 1 pp. 6.3.1-6.3.12, John Wiley and Sons, Toronto. 1991; deVries et al., *J. Exp. Med.* 173:1205-1211, 1991; Moreau et al., *Nature*  
25 336:690-692, 1988; Greenberger et al., *Proc. Natl. Acad. Sci. U.S.A.* 80:2931-2938, 1983; Measurement of mouse and human interleukin 6 - Nordan, R. In *Current Protocols in Immunology*. J.E.e.a. Coligan eds. Vol 1 pp. 6.6.1-6.6.5, John Wiley and Sons, Toronto. 1991; Smith et al., *Proc. Natl. Acad. Sci. U.S.A.* 83:1857-1861, 1986; Measurement of human Interleukin 11 - Bennett, F., Giannotti, J., Clark, S.C. and Turner, K. J. In *Current Protocols*  
30 *in Immunology*. J.E.e.a. Coligan eds. Vol 1 pp. 6.15.1 John Wiley and Sons, Toronto. 1991; Measurement of mouse and human Interleukin 9 - Ciarletta, A., Giannotti, J., Clark, S.C. and Turner, K.J. In *Current Protocols in Immunology*. J.E.e.a. Coligan eds. Vol 1 pp. 6.13.1, John Wiley and Sons, Toronto. 1991.

Assays for T-cell clone responses to antigens (which will identify, among others, proteins that affect APC-T cell interactions as well as direct T-cell effects by measuring proliferation and cytokine production) include, without limitation, those described in: Current Protocols in Immunology, Ed by J. E. Coligan, A.M. Kruisbeek, D.H. Margulies, E.M. Shevach, W Strober, Pub. Greene Publishing Associates and Wiley-Interscience (Chapter 3, In Vitro assays for Mouse Lymphocyte Function; Chapter 6, Cytokines and their cellular receptors; Chapter 7, Immunologic studies in Humans); Weinberger et al., Proc. Natl. Acad. Sci. USA 77:6091-6095, 1980; Weinberger et al., Eur. J. Immun. 11:405-411, 1981; Takai et al., J. Immunol. 137:3494-3500, 1986; Takai et al., J. Immunol. 140:508-512, 1988.

#### Immune Stimulating or Suppressing Activity

A protein of the present invention may also exhibit immune stimulating or immune suppressing activity, including without limitation the activities for which assays are described herein. A protein may be useful in the treatment of various immune deficiencies and disorders (including severe combined immunodeficiency (SCID)), e.g., in regulating (up or down) growth and proliferation of T and/or B lymphocytes, as well as effecting the cytolytic activity of NK cells and other cell populations. These immune deficiencies may be genetic or be caused by viral (e.g., HIV) as well as bacterial or fungal infections, or may result from autoimmune disorders. More specifically, infectious diseases caused by viral, bacterial, fungal or other infection may be treatable using a protein of the present invention, including infections by HIV, hepatitis viruses, herpesviruses, mycobacteria, Leishmania spp., malaria spp. and various fungal infections such as candidiasis. Of course, in this regard, a protein of the present invention may also be useful where a boost to the immune system generally may be desirable, i.e., in the treatment of cancer.

Autoimmune disorders which may be treated using a protein of the present invention include, for example, connective tissue disease, multiple sclerosis, systemic lupus erythematosus, rheumatoid arthritis, autoimmune pulmonary inflammation, Guillain-Barre syndrome, autoimmune thyroiditis, insulin dependent diabetes mellitus, myasthenia gravis, graft-versus-host disease and autoimmune inflammatory eye disease. Such a protein of the present invention may also be useful in the treatment of allergic reactions and conditions, such as asthma (particularly allergic asthma) or other respiratory problems. Other conditions, in which immune suppression is desired (including, for

example, organ transplantation), may also be treatable using a protein of the present invention.

Using the proteins of the invention it may also be possible to immune responses, in a number of ways. Down regulation may be in the form of inhibiting or blocking an immune response already in progress or may involve preventing the induction of an immune response. The functions of activated T cells may be inhibited by suppressing T cell responses or by inducing specific tolerance in T cells, or both. Immunosuppression of T cell responses is generally an active, non-antigen-specific, process which requires continuous exposure of the T cells to the suppressive agent. Tolerance, which involves inducing non-responsiveness or anergy in T cells, is distinguishable from immunosuppression in that it is generally antigen-specific and persists after exposure to the tolerizing agent has ceased. Operationally, tolerance can be demonstrated by the lack of a T cell response upon reexposure to specific antigen in the absence of the tolerizing agent.

Down regulating or preventing one or more antigen functions (including without limitation B lymphocyte antigen functions (such as , for example, B7)), *e.g.*, preventing high level lymphokine synthesis by activated T cells, will be useful in situations of tissue, skin and organ transplantation and in graft-versus-host disease (GVHD). For example, blockage of T cell function should result in reduced tissue destruction in tissue transplantation. Typically, in tissue transplants, rejection of the transplant is initiated through its recognition as foreign by T cells, followed by an immune reaction that destroys the transplant. The administration of a molecule which inhibits or blocks interaction of a B7 lymphocyte antigen with its natural ligand(s) on immune cells (such as a soluble, monomeric form of a peptide having B7-2 activity alone or in conjunction with a monomeric form of a peptide having an activity of another B lymphocyte antigen (*e.g.*, B7-1, B7-3) or blocking antibody), prior to transplantation can lead to the binding of the molecule to the natural ligand(s) on the immune cells without transmitting the corresponding costimulatory signal. Blocking B lymphocyte antigen function in this matter prevents cytokine synthesis by immune cells, such as T cells, and thus acts as an immunosuppressant. Moreover, the lack of costimulation may also be sufficient to anergize the T cells, thereby inducing tolerance in a subject. Induction of long-term tolerance by B lymphocyte antigen-blocking reagents may avoid the necessity of repeated administration of these blocking reagents. To achieve sufficient immunosuppression or

tolerance in a subject, it may also be necessary to block the function of a combination of B lymphocyte antigens.

The efficacy of particular blocking reagents in preventing organ transplant rejection or GVHD can be assessed using animal models that are predictive of efficacy in humans. Examples of appropriate systems which can be used include allogeneic cardiac grafts in rats and xenogeneic pancreatic islet cell grafts in mice, both of which have been used to examine the immunosuppressive effects of CTLA4Ig fusion proteins *in vivo* as described in Lenschow *et al.*, Science 257:789-792 (1992) and Turka *et al.*, Proc. Natl. Acad. Sci USA, 89:11102-11105 (1992). In addition, murine models of GVHD (see Paul ed., Fundamental Immunology, Raven Press, New York, 1989, pp. 846-847) can be used to determine the effect of blocking B lymphocyte antigen function *in vivo* on the development of that disease.

Blocking antigen function may also be therapeutically useful for treating autoimmune diseases. Many autoimmune disorders are the result of inappropriate activation of T cells that are reactive against self tissue and which promote the production of cytokines and autoantibodies involved in the pathology of the diseases. Preventing the activation of autoreactive T cells may reduce or eliminate disease symptoms. Administration of reagents which block costimulation of T cells by disrupting receptor:ligand interactions of B lymphocyte antigens can be used to inhibit T cell activation and prevent production of autoantibodies or T cell-derived cytokines which may be involved in the disease process. Additionally, blocking reagents may induce antigen-specific tolerance of autoreactive T cells which could lead to long-term relief from the disease. The efficacy of blocking reagents in preventing or alleviating autoimmune disorders can be determined using a number of well-characterized animal models of human autoimmune diseases. Examples include murine experimental autoimmune encephalitis, systemic lupus erythematosis in MRL/*lpr/lpr* mice or NZB hybrid mice, murine autoimmune collagen arthritis, diabetes mellitus in NOD mice and BB rats, and murine experimental myasthenia gravis (see Paul ed., Fundamental Immunology, Raven Press, New York, 1989, pp. 840-856).

Upregulation of an antigen function (preferably a B lymphocyte antigen function), as a means of up regulating immune responses, may also be useful in therapy. Upregulation of immune responses may be in the form of enhancing an existing immune response or eliciting an initial immune response. For example, enhancing an immune response through stimulating B lymphocyte antigen function may be useful in cases of

viral infection. In addition, systemic viral diseases such as influenza, the common cold, and encephalitis might be alleviated by the administration of stimulatory forms of B lymphocyte antigens systemically.

Alternatively, anti-viral immune responses may be enhanced in an infected patient  
5 by removing T cells from the patient, costimulating the T cells *in vitro* with viral antigen-pulsed APCs either expressing a peptide of the present invention or together with a stimulatory form of a soluble peptide of the present invention and reintroducing the *in vitro* activated T cells into the patient. Another method of enhancing anti-viral immune responses would be to isolate infected cells from a patient, transfect them with a nucleic  
10 acid encoding a protein of the present invention as described herein such that the cells express all or a portion of the protein on their surface, and reintroduce the transfected cells into the patient. The infected cells would now be capable of delivering a costimulatory signal to, and thereby activate, T cells *in vivo*.

In another application, up regulation or enhancement of antigen function  
15 (preferably B lymphocyte antigen function) may be useful in the induction of tumor immunity. Tumor cells (*e.g.*, sarcoma, melanoma, lymphoma, leukemia, neuroblastoma, carcinoma) transfected with a nucleic acid encoding at least one peptide of the present invention can be administered to a subject to overcome tumor-specific tolerance in the subject. If desired, the tumor cell can be transfected to express a combination of peptides.  
20 For example, tumor cells obtained from a patient can be transfected *ex vivo* with an expression vector directing the expression of a peptide having B7-2-like activity alone, or in conjunction with a peptide having B7-1-like activity and/or B7-3-like activity. The transfected tumor cells are returned to the patient to result in expression of the peptides on the surface of the transfected cell. Alternatively, gene therapy techniques can be used  
25 to target a tumor cell for transfection *in vivo*.

The presence of the peptide of the present invention having the activity of a B lymphocyte antigen(s) on the surface of the tumor cell provides the necessary costimulation signal to T cells to induce a T cell mediated immune response against the transfected tumor cells. In addition, tumor cells which lack MHC class I or MHC class II  
30 molecules, or which fail to reexpress sufficient amounts of MHC class I or MHC class II molecules, can be transfected with nucleic acid encoding all or a portion of (*e.g.*, a cytoplasmic-domain truncated portion) of an MHC class I  $\alpha$  chain protein and  $\beta_2$  microglobulin protein or an MHC class II  $\alpha$  chain protein and an MHC class II  $\beta$  chain protein to thereby express MHC class I or MHC class II proteins on the cell surface.



Expression of the appropriate class I or class II MHC in conjunction with a peptide having the activity of a B lymphocyte antigen (*e.g.*, B7-1, B7-2, B7-3) induces a T cell mediated immune response against the transfected tumor cell. Optionally, a gene encoding an antisense construct which blocks expression of an MHC class II associated protein, such as the invariant chain, can also be cotransfected with a DNA encoding a peptide having the activity of a B lymphocyte antigen to promote presentation of tumor associated antigens and induce tumor specific immunity. Thus, the induction of a T cell mediated immune response in a human subject may be sufficient to overcome tumor-specific tolerance in the subject.

10           The activity of a protein of the invention may, among other means, be measured by the following methods:

Suitable assays for thymocyte or splenocyte cytotoxicity include, without limitation, those described in: *Current Protocols in Immunology*, Ed by J. E. Coligan, A.M. Kruisbeek, D.H. Margulies, E.M. Shevach, W Strober, Pub. Greene Publishing Associates and Wiley-Interscience (Chapter 3, *In Vitro* assays for Mouse Lymphocyte Function 3.1-3.19; Chapter 7, *Immunologic studies in Humans*); Herrmann et al., *Proc. Natl. Acad. Sci. USA* 78:2488-2492, 1981; Herrmann et al., *J. Immunol.* 128:1968-1974, 1982; Handa et al., *J. Immunol.* 135:1564-1572, 1985; Takai et al., *J. Immunol.* 137:3494-3500, 1986; Takai et al., *J. Immunol.* 140:508-512, 1988; Herrmann et al., *Proc. Natl. Acad. Sci. USA* 78:2488-2492, 1981; Herrmann et al., *J. Immunol.* 128:1968-1974, 1982; Handa et al., *J. Immunol.* 135:1564-1572, 1985; Takai et al., *J. Immunol.* 137:3494-3500, 1986; Bowman et al., *J. Virology* 61:1992-1998; Takai et al., *J. Immunol.* 140:508-512, 1988; Bertagnolli et al., *Cellular Immunology* 133:327-341, 1991; Brown et al., *J. Immunol.* 153:3079-3092, 1994.

25           Assays for T-cell-dependent immunoglobulin responses and isotype switching (which will identify, among others, proteins that modulate T-cell dependent antibody responses and that affect Th1/Th2 profiles) include, without limitation, those described in: Maliszewski, *J. Immunol.* 144:3028-3033, 1990; and Assays for B cell function: *In vitro* antibody production, Mond, J.J. and Brunswick, M. In *Current Protocols in Immunology*. J.E.e.a. Coligan eds. Vol 1 pp. 3.8.1-3.8.16, John Wiley and Sons, Toronto. 1994.

30           Mixed lymphocyte reaction (MLR) assays (which will identify, among others, proteins that generate predominantly Th1 and CTL responses) include, without limitation, those described in: *Current Protocols in Immunology*, Ed by J. E. Coligan, A.M. Kruisbeek, D.H. Margulies, E.M. Shevach, W Strober, Pub. Greene Publishing Associates and Wiley-Interscience (Chapter 3, *In Vitro* assays for Mouse Lymphocyte Function 3.1-3.19; Chapter

7, Immunologic studies in Humans); Takai et al., J. Immunol. 137:3494-3500, 1986; Takai et al., J. Immunol. 140:508-512, 1988; Bertagnolli et al., J. Immunol. 149:3778-3783, 1992.

Dendritic cell-dependent assays (which will identify, among others, proteins expressed by dendritic cells that activate naive T-cells) include, without limitation, those described in: Guery et al., J. Immunol. 134:536-544, 1995; Inaba et al., Journal of Experimental Medicine 173:549-559, 1991; Macatonia et al., Journal of Immunology 154:5071-5079, 1995; Porgador et al., Journal of Experimental Medicine 182:255-260, 1995; Nair et al., Journal of Virology 67:4062-4069, 1993; Huang et al., Science 264:961-965, 1994; Macatonia et al., Journal of Experimental Medicine 169:1255-1264, 1989; Bhardwaj et al., Journal of Clinical Investigation 94:797-807, 1994; and Inaba et al., Journal of Experimental Medicine 172:631-640, 1990.

Assays for lymphocyte survival/apoptosis (which will identify, among others, proteins that prevent apoptosis after superantigen induction and proteins that regulate lymphocyte homeostasis) include, without limitation, those described in: Darzynkiewicz et al., Cytometry 13:795-808, 1992; Gorczyca et al., Leukemia 7:659-670, 1993; Gorczyca et al., Cancer Research 53:1945-1951, 1993; Itoh et al., Cell 66:233-243, 1991; Zacharchuk, Journal of Immunology 145:4037-4045, 1990; Zamai et al., Cytometry 14:891-897, 1993; Gorczyca et al., International Journal of Oncology 1:639-648, 1992.

Assays for proteins that influence early steps of T-cell commitment and development include, without limitation, those described in: Antica et al., Blood 84:111-117, 1994; Fine et al., Cellular Immunology 155:111-122, 1994; Galy et al., Blood 85:2770-2778, 1995; Toki et al., Proc. Nat. Acad. Sci. USA 88:7548-7551, 1991.

#### Hematopoiesis Regulating Activity

A protein of the present invention may be useful in regulation of hematopoiesis and, consequently, in the treatment of myeloid or lymphoid cell deficiencies. Even marginal biological activity in support of colony forming cells or of factor-dependent cell lines indicates involvement in regulating hematopoiesis, e.g. in supporting the growth and proliferation of erythroid progenitor cells alone or in combination with other cytokines, thereby indicating utility, for example, in treating various anemias or for use in conjunction with irradiation/chemotherapy to stimulate the production of erythroid precursors and/or erythroid cells; in supporting the growth and proliferation of myeloid cells such as granulocytes and monocytes/macrophages (i.e., traditional CSF activity) useful, for example, in conjunction with chemotherapy to prevent or treat consequent

myelo-suppression; in supporting the growth and proliferation of megakaryocytes and consequently of platelets thereby allowing prevention or treatment of various platelet disorders such as thrombocytopenia, and generally for use in place of or complimentary to platelet transfusions; and/or in supporting the growth and proliferation of hematopoietic stem cells which are capable of maturing to any and all of the above-mentioned hematopoietic cells and therefore find therapeutic utility in various stem cell disorders (such as those usually treated with transplantation, including, without limitation, aplastic anemia and paroxysmal nocturnal hemoglobinuria), as well as in repopulating the stem cell compartment post irradiation/chemotherapy, either *in-vivo* or *ex-vivo* (i.e., in conjunction with bone marrow transplantation or with peripheral progenitor cell transplantation (homologous or heterologous)) as normal cells or genetically manipulated for gene therapy.

The activity of a protein of the invention may, among other means, be measured by the following methods:

Suitable assays for proliferation and differentiation of various hematopoietic lines are cited above.

Assays for embryonic stem cell differentiation (which will identify, among others, proteins that influence embryonic differentiation hematopoiesis) include, without limitation, those described in: Johansson et al. Cellular Biology 15:141-151, 1995; Keller et al., Molecular and Cellular Biology 13:473-486, 1993; McClanahan et al., Blood 81:2903-2915, 1993.

Assays for stem cell survival and differentiation (which will identify, among others, proteins that regulate lympho-hematopoiesis) include, without limitation, those described in: Methylcellulose colony forming assays, Freshney, M.G. In *Culture of Hematopoietic Cells*. R.I. Freshney, et al. eds. Vol pp. 265-268, Wiley-Liss, Inc., New York, NY. 1994; Hirayama et al., Proc. Natl. Acad. Sci. USA 89:5907-5911, 1992; Primitive hematopoietic colony forming cells with high proliferative potential, McNiece, I.K. and Briddell, R.A. In *Culture of Hematopoietic Cells*. R.I. Freshney, et al. eds. Vol pp. 23-39, Wiley-Liss, Inc., New York, NY. 1994; Neben et al., Experimental Hematology 22:353-359, 1994; Cobblestone area forming cell assay, Ploemacher, R.E. In *Culture of Hematopoietic Cells*. R.I. Freshney, et al. eds. Vol pp. 1-21, Wiley-Liss, Inc., New York, NY. 1994; Long term bone marrow cultures in the presence of stromal cells, Spooner, E., Dexter, M. and Allen, T. In *Culture of Hematopoietic Cells*. R.I. Freshney, et al. eds. Vol pp. 163-179, Wiley-Liss, Inc., New York, NY. 1994; Long term culture initiating cell assay, Sutherland,

H.J. In *Culture of Hematopoietic Cells*. R.I. Freshney, *et al.* eds. Vol pp. 139-162, Wiley-Liss, Inc., New York, NY. 1994.

#### Tissue Growth Activity

5 A protein of the present invention also may have utility in compositions used for bone, cartilage, tendon, ligament and/or nerve tissue growth or regeneration, as well as for wound healing and tissue repair and replacement, and in the treatment of burns, incisions and ulcers.

A protein of the present invention, which induces cartilage and/or bone growth  
10 in circumstances where bone is not normally formed, has application in the healing of bone fractures and cartilage damage or defects in humans and other animals. Such a preparation employing a protein of the invention may have prophylactic use in closed as well as open fracture reduction and also in the improved fixation of artificial joints. *De novo* bone formation induced by an osteogenic agent contributes to the repair of  
15 congenital, trauma induced, or oncologic resection induced craniofacial defects, and also is useful in cosmetic plastic surgery.

A protein of this invention may also be used in the treatment of periodontal disease, and in other tooth repair processes. Such agents may provide an environment to attract bone-forming cells, stimulate growth of bone-forming cells or induce  
20 differentiation of progenitors of bone-forming cells. A protein of the invention may also be useful in the treatment of osteoporosis or osteoarthritis, such as through stimulation of bone and/or cartilage repair or by blocking inflammation or processes of tissue destruction (collagenase activity, osteoclast activity, etc.) mediated by inflammatory processes.

25 Another category of tissue regeneration activity that may be attributable to the protein of the present invention is tendon/ligament formation. A protein of the present invention, which induces tendon/ligament-like tissue or other tissue formation in circumstances where such tissue is not normally formed, has application in the healing of tendon or ligament tears, deformities and other tendon or ligament defects in humans and  
30 other animals. Such a preparation employing a tendon/ligament-like tissue inducing protein may have prophylactic use in preventing damage to tendon or ligament tissue, as well as use in the improved fixation of tendon or ligament to bone or other tissues, and in repairing defects to tendon or ligament tissue. *De novo* tendon/ligament-like tissue formation induced by a composition of the present invention contributes to the repair of

congenital, trauma induced, or other tendon or ligament defects of other origin, and is also useful in cosmetic plastic surgery for attachment or repair of tendons or ligaments. The compositions of the present invention may provide an environment to attract tendon- or ligament-forming cells, stimulate growth of tendon- or ligament-forming cells, induce  
5 differentiation of progenitors of tendon- or ligament-forming cells, or induce growth of tendon/ligament cells or progenitors *ex vivo* for return *in vivo* to effect tissue repair. The compositions of the invention may also be useful in the treatment of tendinitis, carpal tunnel syndrome and other tendon or ligament defects. The compositions may also include an appropriate matrix and/or sequestering agent as a carrier as is well known in  
10 the art.

The protein of the present invention may also be useful for proliferation of neural cells and for regeneration of nerve and brain tissue, *i.e.* for the treatment of central and peripheral nervous system diseases and neuropathies, as well as mechanical and traumatic disorders, which involve degeneration, death or trauma to neural cells or nerve  
15 tissue. More specifically, a protein may be used in the treatment of diseases of the peripheral nervous system, such as peripheral nerve injuries, peripheral neuropathy and localized neuropathies, and central nervous system diseases, such as Alzheimer's, Parkinson's disease, Huntington's disease, amyotrophic lateral sclerosis, and Shy-Drager syndrome. Further conditions which may be treated in accordance with the present  
20 invention include mechanical and traumatic disorders, such as spinal cord disorders, head trauma and cerebrovascular diseases such as stroke. Peripheral neuropathies resulting from chemotherapy or other medical therapies may also be treatable using a protein of the invention.

Proteins of the invention may also be useful to promote better or faster closure of  
25 non-healing wounds, including without limitation pressure ulcers, ulcers associated with vascular insufficiency, surgical and traumatic wounds, and the like.

It is expected that a protein of the present invention may also exhibit activity for generation or regeneration of other tissues, such as organs (including, for example, pancreas, liver, intestine, kidney, skin, endothelium), muscle (smooth, skeletal or cardiac)  
30 and vascular (including vascular endothelium) tissue, or for promoting the growth of cells comprising such tissues. Part of the desired effects may be by inhibition or modulation of fibrotic scarring to allow normal tissue to regenerate. A protein of the invention may also exhibit angiogenic activity.

A protein of the present invention may also be useful for gut protection or regeneration and treatment of lung or liver fibrosis, reperfusion injury in various tissues, and conditions resulting from systemic cytokine damage.

5 A protein of the present invention may also be useful for promoting or inhibiting differentiation of tissues described above from precursor tissues or cells; or for inhibiting the growth of tissues described above.

The activity of a protein of the invention may, among other means, be measured by the following methods:

10 Assays for tissue generation activity include, without limitation, those described in: International Patent Publication No. WO95/16035 (bone, cartilage, tendon); International Patent Publication No. WO95/05846 (nerve, neuronal); International Patent Publication No. WO91/07491 (skin, endothelium ).

15 Assays for wound healing activity include, without limitation, those described in: Winter, Epidermal Wound Healing, pps. 71-112 (Maibach, HI and Rovee, DT, eds.), Year Book Medical Publishers, Inc., Chicago, as modified by Eaglstein and Mertz, J. Invest. Dermatol 71:382-84 (1978).

#### Activin/Inhibin Activity

20 A protein of the present invention may also exhibit activin- or inhibin-related activities. Inhibins are characterized by their ability to inhibit the release of follicle stimulating hormone (FSH), while activins and are characterized by their ability to stimulate the release of follicle stimulating hormone (FSH). Thus, a protein of the present invention, alone or in heterodimers with a member of the inhibin  $\alpha$  family, may be useful as a contraceptive based on the ability of inhibins to decrease fertility in female mammals  
25 and decrease spermatogenesis in male mammals. Administration of sufficient amounts of other inhibins can induce infertility in these mammals. Alternatively, the protein of the invention, as a homodimer or as a heterodimer with other protein subunits of the inhibin- $\beta$  group, may be useful as a fertility inducing therapeutic, based upon the ability of activin molecules in stimulating FSH release from cells of the anterior pituitary. See, for example,  
30 United States Patent 4,798,885. A protein of the invention may also be useful for advancement of the onset of fertility in sexually immature mammals, so as to increase the lifetime reproductive performance of domestic animals such as cows, sheep and pigs.

The activity of a protein of the invention may, among other means, be measured by the following methods:

Assays for activin/inhibin activity include, without limitation, those described in: Vale et al., *Endocrinology* 91:562-572, 1972; Ling et al., *Nature* 321:779-782, 1986; Vale et al., *Nature* 321:776-779, 1986; Mason et al., *Nature* 318:659-663, 1985; Forage et al., *Proc. Natl. Acad. Sci. USA* 83:3091-3095, 1986.

5

#### Chemotactic/Chemokinetic Activity

A protein of the present invention may have chemotactic or chemokinetic activity (e.g., act as a chemokine) for mammalian cells, including, for example, monocytes, fibroblasts, neutrophils, T-cells, mast cells, eosinophils, epithelial and/or endothelial cells.

- 10 Chemotactic and chemokinetic proteins can be used to mobilize or attract a desired cell population to a desired site of action. Chemotactic or chemokinetic proteins provide particular advantages in treatment of wounds and other trauma to tissues, as well as in treatment of localized infections. For example, attraction of lymphocytes, monocytes or neutrophils to tumors or sites of infection may result in improved immune responses
- 15 against the tumor or infecting agent.

- A protein or peptide has chemotactic activity for a particular cell population if it can stimulate, directly or indirectly, the directed orientation or movement of such cell population. Preferably, the protein or peptide has the ability to directly stimulate directed movement of cells. Whether a particular protein has chemotactic activity for a population
- 20 of cells can be readily determined by employing such protein or peptide in any known assay for cell chemotaxis.

The activity of a protein of the invention may, among other means, be measured by the following methods:

- Assays for chemotactic activity (which will identify proteins that induce or prevent
- 25 chemotaxis) consist of assays that measure the ability of a protein to induce the migration of cells across a membrane as well as the ability of a protein to induce the adhesion of one cell population to another cell population. Suitable assays for movement and adhesion include, without limitation, those described in: *Current Protocols in Immunology*, Ed by J.E. Coligan, A.M. Kruisbeek, D.H. Margulies, E.M. Shevach, W. Strober, Pub. Greene
- 30 Publishing Associates and Wiley-Interscience (Chapter 6.12, Measurement of alpha and beta Chemokines 6.12.1-6.12.28; Taub et al. *J. Clin. Invest.* 95:1370-1376, 1995; Lind et al. *APMIS* 103:140-146, 1995; Muller et al. *Eur. J. Immunol.* 25: 1744-1748; Gruber et al. *J. of Immunol.* 152:5860-5867, 1994; Johnston et al. *J. of Immunol.* 153: 1762-1768, 1994.

### Hemostatic and Thrombolytic Activity

A protein of the invention may also exhibit hemostatic or thrombolytic activity. As a result, such a protein is expected to be useful in treatment of various coagulation disorders (including hereditary disorders, such as hemophilias) or to enhance coagulation and other hemostatic events in treating wounds resulting from trauma, surgery or other causes. A protein of the invention may also be useful for dissolving or inhibiting formation of thromboses and for treatment and prevention of conditions resulting therefrom (such as, for example, infarction of cardiac and central nervous system vessels (e.g., stroke).

10       The activity of a protein of the invention may, among other means, be measured by the following methods:

Assay for hemostatic and thrombolytic activity include, without limitation, those described in: Linet et al., J. Clin. Pharmacol. 26:131-140, 1986; Burdick et al., Thrombosis Res. 45:413-419, 1987; Humphrey et al., Fibrinolysis 5:71-79 (1991); Schaub, Prostaglandins  
15   35:467-474, 1988.

### Receptor/Ligand Activity

A protein of the present invention may also demonstrate activity as receptors, receptor ligands or inhibitors or agonists of receptor/ligand interactions. Examples of  
20   such receptors and ligands include, without limitation, cytokine receptors and their ligands, receptor kinases and their ligands, receptor phosphatases and their ligands, receptors involved in cell-cell interactions and their ligands (including without limitation, cellular adhesion molecules (such as selectins, integrins and their ligands) and receptor/ligand pairs involved in antigen presentation, antigen recognition and  
25   development of cellular and humoral immune responses). Receptors and ligands are also useful for screening of potential peptide or small molecule inhibitors of the relevant receptor/ligand interaction. A protein of the present invention (including, without limitation, fragments of receptors and ligands) may themselves be useful as inhibitors of receptor/ligand interactions.

30       The activity of a protein of the invention may, among other means, be measured by the following methods:

Suitable assays for receptor-ligand activity include without limitation those described in: Current Protocols in Immunology, Ed by J.E. Coligan, A.M. Kruisbeek, D.H. Margulies, E.M. Shevach, W. Strober, Pub. Greene Publishing Associates and



Wiley-Interscience (Chapter 7.28, Measurement of Cellular Adhesion under static conditions 7.28.1-7.28.22), Takai et al., Proc. Natl. Acad. Sci. USA 84:6864-6868, 1987; Bierer et al., J. Exp. Med. 168:1145-1156, 1988; Rosenstein et al., J. Exp. Med. 169:149-160 1989; Stoltenborg et al., J. Immunol. Methods 175:59-68, 1994; Stitt et al., Cell 80:661-670, 5 1995.

#### Anti-Inflammatory Activity

Proteins of the present invention may also exhibit anti-inflammatory activity. The anti-inflammatory activity may be achieved by providing a stimulus to cells involved in 10 the inflammatory response, by inhibiting or promoting cell-cell interactions (such as, for example, cell adhesion), by inhibiting or promoting chemotaxis of cells involved in the inflammatory process, inhibiting or promoting cell extravasation, or by stimulating or suppressing production of other factors which more directly inhibit or promote an inflammatory response. Proteins exhibiting such activities can be used to treat 15 inflammatory conditions including chronic or acute conditions), including without limitation inflammation associated with infection (such as septic shock, sepsis or systemic inflammatory response syndrome (SIRS)), ischemia-reperfusion injury, endotoxin lethality, arthritis, complement-mediated hyperacute rejection, nephritis, cytokine or chemokine-induced lung injury, inflammatory bowel disease, Crohn's disease or resulting 20 from over production of cytokines such as TNF or IL-1. Proteins of the invention may also be useful to treat anaphylaxis and hypersensitivity to an antigenic substance or material.

#### Cadherin/Tumor Invasion Suppressor Activity

Cadherins are calcium-dependent adhesion molecules that appear to play major 25 roles during development, particularly in defining specific cell types. Loss or alteration of normal cadherin expression can lead to changes in cell adhesion properties linked to tumor growth and metastasis. Cadherin malfunction is also implicated in other human diseases, such as pemphigus vulgaris and pemphigus foliaceus (auto-immune blistering skin diseases), Crohn's disease, and some developmental abnormalities.

30 The cadherin superfamily includes well over forty members, each with a distinct pattern of expression. All members of the superfamily have in common conserved extracellular repeats (cadherin domains), but structural differences are found in other parts of the molecule. The cadherin domains bind calcium to form their tertiary structure and thus calcium is required to mediate their adhesion. Only a few amino acids in the

first cadherin domain provide the basis for homophilic adhesion; modification of this recognition site can change the specificity of a cadherin so that instead of recognizing only itself, the mutant molecule can now also bind to a different cadherin. In addition, some cadherins engage in heterophilic adhesion with other cadherins.

5 E-cadherin, one member of the cadherin superfamily, is expressed in epithelial cell types. Pathologically, if E-cadherin expression is lost in a tumor, the malignant cells become invasive and the cancer metastasizes. Transfection of cancer cell lines with polynucleotides expressing E-cadherin has reversed cancer-associated changes by returning altered cell shapes to normal, restoring cells' adhesiveness to each other and to  
10 their substrate, decreasing the cell growth rate, and drastically reducing anchorage-independent cell growth. Thus, reintroducing E-cadherin expression reverts carcinomas to a less advanced stage. It is likely that other cadherins have the same invasion suppressor role in carcinomas derived from other tissue types. Therefore, proteins of the present invention with cadherin activity, and polynucleotides of the present invention  
15 encoding such proteins, can be used to treat cancer. Introducing such proteins or polynucleotides into cancer cells can reduce or eliminate the cancerous changes observed in these cells by providing normal cadherin expression.

Cancer cells have also been shown to express cadherins of a different tissue type than their origin, thus allowing these cells to invade and metastasize in a different tissue  
20 in the body. Proteins of the present invention with cadherin activity, and polynucleotides of the present invention encoding such proteins, can be substituted in these cells for the inappropriately expressed cadherins, restoring normal cell adhesive properties and reducing or eliminating the tendency of the cells to metastasize.

Additionally, proteins of the present invention with cadherin activity, and  
25 polynucleotides of the present invention encoding such proteins, can be used to generate antibodies recognizing and binding to cadherins. Such antibodies can be used to block the adhesion of inappropriately expressed tumor-cell cadherins, preventing the cells from forming a tumor elsewhere. Such an anti-cadherin antibody can also be used as a marker for the grade, pathological type, and prognosis of a cancer, i.e. the more progressed the  
30 cancer, the less cadherin expression there will be, and this decrease in cadherin expression can be detected by the use of a cadherin-binding antibody.

Fragments of proteins of the present invention with cadherin activity, preferably a polypeptide comprising a decapeptide of the cadherin recognition site, and polynucleotides of the present invention encoding such protein fragments, can also be used

to block cadherin function by binding to cadherins and preventing them from binding in ways that produce undesirable effects. Additionally, fragments of proteins of the present invention with cadherin activity, preferably truncated soluble cadherin fragments which have been found to be stable in the circulation of cancer patients, and polynucleotides  
5 encoding such protein fragments, can be used to disturb proper cell-cell adhesion.

Assays for cadherin adhesive and invasive suppressor activity include, without limitation, those described in: Hortsch et al. J Biol Chem 270 (32): 18809-18817, 1995; Miyaki et al. Oncogene 11: 2547-2552, 1995; Ozawa et al. Cell 63: 1033-1038, 1990.

#### 10 Tumor Inhibition Activity

In addition to the activities described above for immunological treatment or prevention of tumors, a protein of the invention may exhibit other anti-tumor activities. A protein may inhibit tumor growth directly or indirectly (such as, for example, via ADCC). A protein may exhibit its tumor inhibitory activity by acting on tumor tissue or  
15 tumor precursor tissue, by inhibiting formation of tissues necessary to support tumor growth (such as, for example, by inhibiting angiogenesis), by causing production of other factors, agents or cell types which inhibit tumor growth, or by suppressing, eliminating or inhibiting factors, agents or cell types which promote tumor growth.

#### 20 Other Activities

A protein of the invention may also exhibit one or more of the following additional activities or effects: inhibiting the growth, infection or function of, or killing, infectious agents, including, without limitation, bacteria, viruses, fungi and other parasites; effecting (suppressing or enhancing) bodily characteristics, including, without limitation, height,  
25 weight, hair color, eye color, skin, fat to lean ratio or other tissue pigmentation, or organ or body part size or shape (such as, for example, breast augmentation or diminution, change in bone form or shape); effecting biorhythms or circadian cycles or rhythms; effecting the fertility of male or female subjects; effecting the metabolism, catabolism, anabolism, processing, utilization, storage or elimination of dietary fat, lipid, protein,  
30 carbohydrate, vitamins, minerals, cofactors or other nutritional factors or component(s); effecting behavioral characteristics, including, without limitation, appetite, libido, stress, cognition (including cognitive disorders), depression (including depressive disorders) and violent behaviors; providing analgesic effects or other pain reducing effects; promoting differentiation and growth of embryonic stem cells in lineages other than hematopoietic

lineages; hormonal or endocrine activity; in the case of enzymes, correcting deficiencies of the enzyme and treating deficiency-related diseases; treatment of hyperproliferative disorders (such as, for example, psoriasis); immunoglobulin-like activity (such as, for example, the ability to bind antigens or complement); and the ability to act as an antigen  
5 in a vaccine composition to raise an immune response against such protein or another material or entity which is cross-reactive with such protein.

#### **ADMINISTRATION AND DOSING**

10 A protein of the present invention (from whatever source derived, including without limitation from recombinant and non-recombinant sources) may be used in a pharmaceutical composition when combined with a pharmaceutically acceptable carrier. Such a composition may also contain (in addition to protein and a carrier) diluents, fillers, salts, buffers, stabilizers, solubilizers, and other materials well known in the art. The term  
15 "pharmaceutically acceptable" means a non-toxic material that does not interfere with the effectiveness of the biological activity of the active ingredient(s). The characteristics of the carrier will depend on the route of administration. The pharmaceutical composition of the invention may also contain cytokines, lymphokines, or other hematopoietic factors such as M-CSF, GM-CSF, TNF, IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-8, IL-9, IL-10, IL-11,  
20 IL-12, IL-13, IL-14, IL-15, IFN, TNF0, TNF1, TNF2, G-CSF, Meg-CSF, thrombopoietin, stem cell factor, and erythropoietin. The pharmaceutical composition may further contain other agents which either enhance the activity of the protein or compliment its activity or use in treatment. Such additional factors and/or agents may be included in the pharmaceutical composition to produce a synergistic effect with protein of the invention,  
25 or to minimize side effects. Conversely, protein of the present invention may be included in formulations of the particular cytokine, lymphokine, other hematopoietic factor, thrombolytic or anti-thrombotic factor, or anti-inflammatory agent to minimize side effects of the cytokine, lymphokine, other hematopoietic factor, thrombolytic or anti-thrombotic factor, or anti-inflammatory agent.

30 A protein of the present invention may be active in multimers (e.g., heterodimers or homodimers) or complexes with itself or other proteins. As a result, pharmaceutical compositions of the invention may comprise a protein of the invention in such multimeric or complexed form.

The pharmaceutical composition of the invention may be in the form of a complex of the protein(s) of present invention along with protein or peptide antigens. The protein and/or peptide antigen will deliver a stimulatory signal to both B and T lymphocytes. B lymphocytes will respond to antigen through their surface immunoglobulin receptor. T  
5 lymphocytes will respond to antigen through the T cell receptor (TCR) following presentation of the antigen by MHC proteins. MHC and structurally related proteins including those encoded by class I and class II MHC genes on host cells will serve to present the peptide antigen(s) to T lymphocytes. The antigen components could also be supplied as purified MHC-peptide complexes alone or with co-stimulatory molecules that  
10 can directly signal T cells. Alternatively antibodies able to bind surface immunoglobulin and other molecules on B cells as well as antibodies able to bind the TCR and other molecules on T cells can be combined with the pharmaceutical composition of the invention.

The pharmaceutical composition of the invention may be in the form of a liposome  
15 in which protein of the present invention is combined, in addition to other pharmaceutically acceptable carriers, with amphipathic agents such as lipids which exist in aggregated form as micelles, insoluble monolayers, liquid crystals, or lamellar layers in aqueous solution. Suitable lipids for liposomal formulation include, without limitation, monoglycerides, diglycerides, sulfatides, lysolecithin, phospholipids, saponin, bile acids,  
20 and the like. Preparation of such liposomal formulations is within the level of skill in the art, as disclosed, for example, in U.S. Patent No. 4,235,871; U.S. Patent No. 4,501,728; U.S. Patent No. 4,837,028; and U.S. Patent No. 4,737,323, all of which are incorporated herein by reference.

As used herein, the term "therapeutically effective amount" means the total  
25 amount of each active component of the pharmaceutical composition or method that is sufficient to show a meaningful patient benefit, i.e., treatment, healing, prevention or amelioration of the relevant medical condition, or an increase in rate of treatment, healing, prevention or amelioration of such conditions. When applied to an individual active ingredient, administered alone, the term refers to that ingredient alone. When applied to  
30 a combination, the term refers to combined amounts of the active ingredients that result in the therapeutic effect, whether administered in combination, serially or simultaneously.

In practicing the method of treatment or use of the present invention, a therapeutically effective amount of protein of the present invention is administered to a mammal having a condition to be treated. Protein of the present invention may be

administered in accordance with the method of the invention either alone or in combination with other therapies such as treatments employing cytokines, lymphokines or other hematopoietic factors. When co-administered with one or more cytokines, lymphokines or other hematopoietic factors, protein of the present invention may be  
5 administered either simultaneously with the cytokine(s), lymphokine(s), other hematopoietic factor(s), thrombolytic or anti-thrombotic factors, or sequentially. If administered sequentially, the attending physician will decide on the appropriate sequence of administering protein of the present invention in combination with cytokine(s), lymphokine(s), other hematopoietic factor(s), thrombolytic or anti-thrombotic  
10 factors.

Administration of protein of the present invention used in the pharmaceutical composition or to practice the method of the present invention can be carried out in a variety of conventional ways, such as oral ingestion, inhalation, topical application or cutaneous, subcutaneous, intraperitoneal, parenteral or intravenous injection.  
15 Intravenous administration to the patient is preferred.

When a therapeutically effective amount of protein of the present invention is administered orally, protein of the present invention will be in the form of a tablet, capsule, powder, solution or elixir. When administered in tablet form, the pharmaceutical composition of the invention may additionally contain a solid carrier such as a gelatin or  
20 an adjuvant. The tablet, capsule, and powder contain from about 5 to 95% protein of the present invention, and preferably from about 25 to 90% protein of the present invention. When administered in liquid form, a liquid carrier such as water, petroleum, oils of animal or plant origin such as peanut oil, mineral oil, soybean oil, or sesame oil, or synthetic oils may be added. The liquid form of the pharmaceutical composition may further contain  
25 physiological saline solution, dextrose or other saccharide solution, or glycols such as ethylene glycol, propylene glycol or polyethylene glycol. When administered in liquid form, the pharmaceutical composition contains from about 0.5 to 90% by weight of protein of the present invention, and preferably from about 1 to 50% protein of the present invention.

30 When a therapeutically effective amount of protein of the present invention is administered by intravenous, cutaneous or subcutaneous injection, protein of the present invention will be in the form of a pyrogen-free, parenterally acceptable aqueous solution. The preparation of such parenterally acceptable protein solutions, having due regard to pH, isotonicity, stability, and the like, is within the skill in the art. A preferred

pharmaceutical composition for intravenous, cutaneous, or subcutaneous injection should contain, in addition to protein of the present invention, an isotonic vehicle such as Sodium Chloride Injection, Ringer's Injection, Dextrose Injection, Dextrose and Sodium Chloride Injection, Lactated Ringer's Injection, or other vehicle as known in the art. The  
5 pharmaceutical composition of the present invention may also contain stabilizers, preservatives, buffers, antioxidants, or other additives known to those of skill in the art.

The amount of protein of the present invention in the pharmaceutical composition of the present invention will depend upon the nature and severity of the condition being treated, and on the nature of prior treatments which the patient has undergone.  
10 Ultimately, the attending physician will decide the amount of protein of the present invention with which to treat each individual patient. Initially, the attending physician will administer low doses of protein of the present invention and observe the patient's response. Larger doses of protein of the present invention may be administered until the optimal therapeutic effect is obtained for the patient, and at that point the dosage is not  
15 increased further. It is contemplated that the various pharmaceutical compositions used to practice the method of the present invention should contain about 0.01 µg to about 100 mg (preferably about 0.1mg to about 10 mg, more preferably about 0.1 µg to about 1 mg) of protein of the present invention per kg body weight.

The duration of intravenous therapy using the pharmaceutical composition of the present invention will vary, depending on the severity of the disease being treated and the condition and potential idiosyncratic response of each individual patient. It is contemplated that the duration of each application of the protein of the present invention will be in the range of 12 to 24 hours of continuous intravenous administration. Ultimately the attending physician will decide on the appropriate duration of intravenous  
25 therapy using the pharmaceutical composition of the present invention.

Protein of the invention may also be used to immunize animals to obtain polyclonal and monoclonal antibodies which specifically react with the protein. Such antibodies may be obtained using either the entire protein or fragments thereof as an immunogen. The peptide immunogens additionally may contain a cysteine residue at the  
30 carboxyl terminus, and are conjugated to a hapten such as keyhole limpet hemocyanin (KLH). Methods for synthesizing such peptides are known in the art, for example, as in R.P. Merrifield, J. Amer.Chem.Soc. 85, 2149-2154 (1963); J.L. Krstenansky, *et al.*, FEBS Lett. 211, 10 (1987). Monoclonal antibodies binding to the protein of the invention may be useful diagnostic agents for the immunodetection of the protein. Neutralizing monoclonal

antibodies binding to the protein may also be useful therapeutics for both conditions associated with the protein and also in the treatment of some forms of cancer where abnormal expression of the protein is involved. In the case of cancerous cells or leukemic cells, neutralizing monoclonal antibodies against the protein may be useful in detecting  
5 and preventing the metastatic spread of the cancerous cells, which may be mediated by the protein.

For compositions of the present invention which are useful for bone, cartilage, tendon or ligament regeneration, the therapeutic method includes administering the composition topically, systematically, or locally as an implant or device. When  
10 administered, the therapeutic composition for use in this invention is, of course, in a pyrogen-free, physiologically acceptable form. Further, the composition may desirably be encapsulated or injected in a viscous form for delivery to the site of bone, cartilage or tissue damage. Topical administration may be suitable for wound healing and tissue repair. Therapeutically useful agents other than a protein of the invention which may also  
15 optionally be included in the composition as described above, may alternatively or additionally, be administered simultaneously or sequentially with the composition in the methods of the invention. Preferably for bone and/or cartilage formation, the composition would include a matrix capable of delivering the protein-containing composition to the site of bone and/or cartilage damage, providing a structure for the  
20 developing bone and cartilage and optimally capable of being resorbed into the body. Such matrices may be formed of materials presently in use for other implanted medical applications.

The choice of matrix material is based on biocompatibility, biodegradability, mechanical properties, cosmetic appearance and interface properties. The particular  
25 application of the compositions will define the appropriate formulation. Potential matrices for the compositions may be biodegradable and chemically defined calcium sulfate, tricalciumphosphate, hydroxyapatite, polylactic acid, polyglycolic acid and polyanhydrides. Other potential materials are biodegradable and biologically well-defined, such as bone or dermal collagen. Further matrices are comprised of pure proteins  
30 or extracellular matrix components. Other potential matrices are nonbiodegradable and chemically defined, such as sintered hydroxapatite, bioglass, aluminates, or other ceramics. Matrices may be comprised of combinations of any of the above mentioned types of material, such as polylactic acid and hydroxyapatite or collagen and tricalciumphosphate. The bioceramics may be altered in composition, such as in calcium-



aluminate-phosphate and processing to alter pore size, particle size, particle shape, and biodegradability.

Presently preferred is a 50:50 (mole weight) copolymer of lactic acid and glycolic acid in the form of porous particles having diameters ranging from 150 to 800 microns.

- 5 In some applications, it will be useful to utilize a sequestering agent, such as carboxymethyl cellulose or autologous blood clot, to prevent the protein compositions from disassociating from the matrix.

A preferred family of sequestering agents is cellulosic materials such as alkylcelluloses (including hydroxyalkylcelluloses), including methylcellulose, 10 ethylcellulose, hydroxyethylcellulose, hydroxypropylcellulose, hydroxypropyl-methylcellulose, and carboxymethylcellulose, the most preferred being cationic salts of carboxymethylcellulose (CMC). Other preferred sequestering agents include hyaluronic acid, sodium alginate, poly(ethylene glycol), polyoxyethylene oxide, carboxyvinyl polymer and poly(vinyl alcohol). The amount of sequestering agent useful herein is 0.5-20 15 wt%, preferably 1-10 wt% based on total formulation weight, which represents the amount necessary to prevent desorption of the protein from the polymer matrix and to provide appropriate handling of the composition, yet not so much that the progenitor cells are prevented from infiltrating the matrix, thereby providing the protein the opportunity to assist the osteogenic activity of the progenitor cells.

- 20 In further compositions, proteins of the invention may be combined with other agents beneficial to the treatment of the bone and/or cartilage defect, wound, or tissue in question. These agents include various growth factors such as epidermal growth factor (EGF), platelet derived growth factor (PDGF), transforming growth factors (TGF- $\alpha$  and TGF- $\beta$ ), and insulin-like growth factor (IGF).

- 25 The therapeutic compositions are also presently valuable for veterinary applications. Particularly domestic animals and thoroughbred horses, in addition to humans, are desired patients for such treatment with proteins of the present invention.

The dosage regimen of a protein-containing pharmaceutical composition to be used in tissue regeneration will be determined by the attending physician considering 30 various factors which modify the action of the proteins, e.g., amount of tissue weight desired to be formed, the site of damage, the condition of the damaged tissue, the size of a wound, type of damaged tissue (e.g., bone), the patient's age, sex, and diet, the severity of any infection, time of administration and other clinical factors. The dosage may vary with the type of matrix used in the reconstitution and with inclusion of other proteins in

the pharmaceutical composition. For example, the addition of other known growth factors, such as IGF I (insulin like growth factor I), to the final composition, may also effect the dosage. Progress can be monitored by periodic assessment of tissue/bone growth and/or repair, for example, X-rays, histomorphometric determinations and tetracycline  
5 labeling.

Polynucleotides of the present invention can also be used for gene therapy. Such polynucleotides can be introduced either *in vivo* or *ex vivo* into cells for expression in a mammalian subject. Polynucleotides of the invention may also be administered by other known methods for introduction of nucleic acid into a cell or organism (including, without  
10 limitation, in the form of viral vectors or naked DNA).

Cells may also be cultured *ex vivo* in the presence of proteins of the present invention in order to proliferate or to produce a desired effect on or activity in such cells. Treated cells can then be introduced *in vivo* for therapeutic purposes.

15 Patent and literature references cited herein are incorporated by reference as if fully set forth.

## SEQUENCE LISTING

## (1) GENERAL INFORMATION:

(i) APPLICANT: Jacobs, Kenneth  
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Agostino, Michael J.

(ii) TITLE OF INVENTION: SECRETED PROTEINS AND POLYNUCLEOTIDES  
ENCODING THEM

(iii) NUMBER OF SEQUENCES: 32

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(A) MEDIUM TYPE: Floppy disk  
(B) COMPUTER: IBM PC compatible  
(C) OPERATING SYSTEM: PC-DOS/MS-DOS  
(D) SOFTWARE: PatentIn Release #1.0, Version #1.30

## (vi) CURRENT APPLICATION DATA:

(A) APPLICATION NUMBER:  
(B) FILING DATE:  
(C) CLASSIFICATION:

## (viii) ATTORNEY/AGENT INFORMATION:

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## (2) INFORMATION FOR SEQ ID NO:1:

## (i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 2199 base pairs  
(B) TYPE: nucleic acid  
(C) STRANDEDNESS: double  
(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:1:

```

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GCAGAGCATC GAGCCAAAGG GGAGATGAGT TTGTCTGTCC TCTGCTGAGG CTACGGCCGG      180
GCCTAGGGAA CTGGGAGCTT GGGTGAAGC GACACCCGTG GAAGTGGGAG GAGGTGGCGC      240
CGGGACTTTA ACCCCTTGTG GGCTCTGCGG CAGGGGATTT AACCCTTTGT GGATCTGGCC      300
CCTCGGAGGC AGCGTCATCG GTAGTTTAA CCCCTTCGGG GCTGGGTTC ACGCACTGGA      360
CTTACCCTCA TCACCTTGCT CACCAACTCC TTTATTGGGG TGCTCCGCTT GGAGGTTTGA      420
GGCCACCTC CGCCATTAC GTACTGTTCC TGCCGCTGCA CCCCTTGGA CCGCTAGCT      480
GGCCGCACTG TGGGCGCTTA ACCCTTTACT GACTTGAGCT CCCAGATTG CAGTTGGAGT      540
TTGCTGATAG AAGGACTAGC TAAAGGCGTC ACTGCAGGAA TTACAACTG AAGAGGACTC      600
TGTTGGACTG TTTTTTTTTT CTTTTCTTT TTTTAAGAA AAACCCATT TTTCTCTAA      660
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CTTGTCAGAA TATCAACACC AGCCTCAAAC TAGCAACTGT ACAGGTGCTG CTGCTGTCCA      780
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TAGGTGGCAA TCGAGAGCGT TCCCCAGTT GGGTGGCCGT CCGGGGCCG AGGGGGAAGG      900
GAGCCTGGAA TCCCAACCAC CTCCCTTGCA GACCCAGGCC TGTCCAGAAT CTAGCTGCCT      960
GAGAGAGGGC GAGAAGGGCC AGAATGGGGA CGACTCGTCC GCTGGCGGCG ACTTCCCGCC      1020
GCCGGCAGAA GTGGAACCGA CGCCGAGGC CGAGCTGCTC GCCAGCCTT GTCATGACTC      1080
CGAGGCCAGT AAGTTGGGGG CTCCTGCCGC AGGGGGCGAA GAGGAGTGGG GACAGCAGCA      1140
GAGACAGCTG GGAAGAAAA AACATAGGAG ACGCCCGTCC AAGAAGAAGC GGCATTGGAA      1200
ACCGTACTAC AAGCTGACCT GGGAAGAGAA GAAAAAGTTC GACGAGAAAC AGAGCCTTCG      1260
AGCTTCAAGG ATCCGAGCCG AGATGTTTCG CAAGGGCCAG CCGGTCGCGC CCTATAACAC      1320
CACGCAGTTC CTCATGGATG ATCAGACCA GGAGGAGCCG GATCTCAAAA CCGCCTGTA      1380
CTCAAGCGG GCCGCCGCA AATCCGACGA CACCAGCGAT GACGACTTCA TGGAAGAAGG      1440

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GGGTGAGGAG GATGGGGGCA GCGATGGGAT GGGAGGGGAC GGCAGCGAGT TTCTGCAGCG 1500
GGACTTCTCG GAGACGTACG AGCGGTACCA CACGGAGAGC CTGCAGAACA TGAGCAAGCA 1560
GGAGCTCATC AAGGAGTACC TGGAACTGGA GAAGTGCCTC TCGCGCATGG AGGACGAGAA 1620
CAACCGGCTG CGGCTGGAGA GCAAGCGGCT GGGTGGCGAC GACGCGCGTG TCGGGGAGCT 1680
GGAGCTGGAG CTGGACCGGC TCGCGCCCGA GAACCTCCAG CTGCTGACCG AGAACGAACT 1740
GCACCGGCAG CAGGAGCGAG CGCCGCTTTC CAAGTTTGA GACTAGACTG AAACCTTTTT 1800
GGGGGAGGGG GCAAAGGGGA CTTTTTACAG TGATGGAATG TAACATTATA TACATGTGTA 1860
TATAAGACAG TGGACCTTTT TATGACACAT AATCAGAAGA GAAATCCCCC TGGCTTTGGT 1920
TGGTTTCGTA AATTAGCTA TATGTAGCTT GCGTGCTTTC TCCTGTTCTT TTAATTATGT 1980
GAAACTGAAG AGTTGCTTTT CTTGTTTTCC TTTTGAAG TTTTTTTCCT TAATGTGAAA 2040
GTAATTTGAC CAAGTTATAA TGCATTTTGG TTTTAAACA ATCCCCTCCT TAAACGGAGC 2100
TATAAGGTGG CCAATCTGA GAACAATTAA ATTCATTTTA GTTATAATAA ATTTAATATT 2160
TGTAATGTA AAAAAAAAAA AAAAAAAAAA AAAAAAAAAA 2199

```

## (2) INFORMATION FOR SEQ ID NO:2:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 359 amino acids
- (B) TYPE: amino acid
- (C) STRANDEDNESS:
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: protein

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:2:

```

Met Ala Glu Pro Phe Leu Ser Glu Tyr Gln His Gln Pro Gln Thr Ser
1           5           10           15
Asn Cys Thr Gly Ala Ala Ala Val Gln Glu Glu Leu Asn Pro Glu Arg
20        25        30
Pro Pro Gly Ala Glu Glu Arg Val Pro Glu Glu Asp Ser Arg Trp Gln
35        40        45
Ser Arg Ala Phe Pro Gln Leu Gly Gly Arg Pro Gly Pro Glu Gly Glu
50        55        60
Gly Ser Leu Glu Ser Gln Pro Pro Pro Leu Gln Thr Gln Ala Cys Pro
65        70        75        80

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Glu Ser Ser Cys Leu Arg Glu Gly Glu Lys Gly Gln Asn Gly Asp Asp  
                             85                            90                            95  
 Ser Ser Ala Gly Gly Asp Phe Pro Pro Pro Ala Glu Val Glu Pro Thr  
                             100                            105                            110  
 Pro Glu Ala Glu Leu Leu Ala Gln Pro Cys His Asp Ser Glu Ala Ser  
                             115                            120                            125  
 Lys Leu Gly Ala Pro Ala Ala Gly Gly Glu Glu Glu Trp Gly Gln Gln  
                             130                            135                            140  
 Gln Arg Gln Leu Gly Lys Lys Lys His Arg Arg Arg Pro Ser Lys Lys  
                             145                            150                            155                            160  
 Lys Arg His Trp Lys Pro Tyr Tyr Lys Leu Thr Trp Glu Glu Lys Lys  
                             165                            170                            175  
 Lys Phe Asp Glu Lys Gln Ser Leu Arg Ala Ser Arg Ile Arg Ala Glu  
                             180                            185                            190  
 Met Phe Ala Lys Gly Gln Pro Val Ala Pro Tyr Asn Thr Thr Gln Phe  
                             195                            200                            205  
 Leu Met Asp Asp His Asp Gln Glu Glu Pro Asp Leu Lys Thr Gly Leu  
                             210                            215                            220  
 Tyr Ser Lys Arg Ala Ala Ala Lys Ser Asp Asp Thr Ser Asp Asp Asp  
                             225                            230                            235                            240  
 Phe Met Glu Glu Gly Gly Glu Glu Asp Gly Gly Ser Asp Gly Met Gly  
                             245                            250                            255  
 Gly Asp Gly Ser Glu Phe Leu Gln Arg Asp Phe Ser Glu Thr Tyr Glu  
                             260                            265                            270  
 Arg Tyr His Thr Glu Ser Leu Gln Asn Met Ser Lys Gln Glu Leu Ile  
                             275                            280                            285  
 Lys Glu Tyr Leu Glu Leu Glu Lys Cys Leu Ser Arg Met Glu Asp Glu  
                             290                            295                            300  
 Asn Asn Arg Leu Arg Leu Glu Ser Lys Arg Leu Gly Gly Asp Asp Ala  
                             305                            310                            315                            320  
 Arg Val Arg Glu Leu Glu Leu Glu Leu Asp Arg Leu Arg Ala Glu Asn  
                             325                            330                            335  
 Leu Gln Leu Leu Thr Glu Asn Glu Leu His Arg Gln Gln Glu Arg Ala  
                             340                            345                            350  
 Pro Leu Ser Lys Phe Gly Asp  
                             355

(2) INFORMATION FOR SEQ ID NO:3:

- (i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 1851 base pairs  
 (B) TYPE: nucleic acid  
 (C) STRANDEDNESS: double  
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:3:

```

GGCTAGGCCG CGAGCTTAGT CCTGGGAGCC GCCTCCGTCG CCGCCGTCAG AGCCGCCCTA      60
TCAGATTATC TTAACAAGAA AACCAACTGG AAAAAAAAAAT GAAATTCCTT ATCTTCGCAT      120
TTTTCGGTGG TGTTCACCTT TTATCCCTGT GCTCTGGGAA AGCTATATGC AAGAATGGCA      180
TCTCTAAGAG GACTTTTGAA GAAATAAAAG AAGAAATAGC CAGCTGTGGA GATGTTGCTA      240
AAGCAATCAT CAACCTAGCT GTTTATGGTA AAGCCCAGAA CAGATCCTAT GAGCGATTGG      300
CACTTCTGGT TGATACTGTT GGACCCAGAC TGAGTGGCTC CAAGAACCTA GAAAAAGCCA      360
TCCAAATTAT GTACCAAAAC CTGCAGCAAG ATGGGCTGGA GAAAGTTCAC CTGGAGCCAG      420
TGAGAATACC CCACTGGGAG AGGGGAGAAG AATCAGCTGT GATGCTGGAG CCAAGAATTC      480
ATAAGATAGC CATCCTGGGT CTTGGCAGCA GCATTGGGAC TCCTCCAGAA GGCATTACAG      540
CAGAAGTTCT GGTGGTGACC TCTTTCGATG AACTGCAGAG AAGGGCCTCA GAAGCAAGAG      600
GGAAGATTGT TGTTTATAAC CAACCTTACA TCAACTACTC AAGGACGGTG CAATACCGAA      660
CGCAGGGGGC GGTGGAAGCT GCCAAGGTGG GGGCTTTGGC ATCTCTCATT CGATCCGTGG      720
CCTCCTTCTC CATCTACAGT CCTCACACAG GTATTTCAGGA ATACCAGGAT GGCGTGCCCA      780
AAATTCCAAC AGCCTGTATT ACGGTGGAAG ATGCAGAAAT GATGTCAAGA ATGGCTTCTC      840
ATGGGATCAA AATTGTCATT CAGCTAAAGA TGGGGGCAAA GACCTACCCA GATACTGATT      900
CCTTCAACAC TGTAGCAGAG ATCACTGGGA GCAAATATCC AGAACAGGTT GTACTGGTCA      960
GTGGACATCT GGACAGCTGG GATGTTGGGC AGGGTGCCAT GGATGATGGC GGTGGAGCCT      1020
TTATATCATG GGAAGCACTC TCACTTATTA AAGATCTTGG GCTGCGTCCA AAGAGGACTC      1080
TGCGGCTGGT GCTCTGGACT GCAGAAGAAC AAGGTGGAGT TGGTGCCTTC CAGTATTATC      1140
AGTTACACAA GGTAAATATT TCCAACTACA GTCTGGTGAT GGAGTCTGAC GCAGGAACCT      1200
TCTTACCCAC TGGGCTGCAA TTTCACTGGCA GTGAAAAGGC CAGGGCCATC ATGGAGGAGG      1260

```

```

TTATGAGCCT GCTGCAGCCC CTCAATATCA CTCAGGTCCT GAGCCATGGA GAAGGGACAG      1320
ACATCAACTT TTGGATCCAA GCTGGAGTGC CTGGAGCCAG TCTACTTGAT GACTTATACA      1380
AGTATTTCTT CTTCATCAC TCCCACGGAG ACACCATGAC TGTCATGGAT CCAAAGCAGA      1440
TGAATGTTGC TGCTGCTGTT TGGGCTGTTG TTTCTTATGT TGTTCAGAC ATGGAAGAAA      1500
TGCTGCCTAG GTCCTAGAAA CAGTAAGAAA GAAACGTTTT CATGCTTCTG GCCAGGAATC      1560
CTGGGTCTGC AACTTTGGAA AACTCCTCTT CACATAACAA TTTCATCCAA TTCATCTTCA      1620
AAGCACAACCT CTATTTTCATG CTTTCTGTTA TTATCTTTCT TGATACTTTC CAAATTCTCT      1680
GATTCTAGAA AAAGGAATCA TTCTCCCCTC CCTCCCACCA CATAGAATCA ACATATGGTA      1740
GGGATTACAG TGGGGGCATT TCTTTATATC ACCTCTTAAA AACATTGTTT CCACTTTAAA      1800
AGTAAACACT TAATAAATTT TTGGAAGATC TCTGAAAAAA AAAAAAAAAA A              1851

```

## (2) INFORMATION FOR SEQ ID NO:4:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 472 amino acids
- (B) TYPE: amino acid
- (C) STRANDEDNESS:
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: protein

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:4:

```

Met Lys Phe Leu Ile Phe Ala Phe Phe Gly Gly Val His Leu Leu Ser
1           5           10           15

Leu Cys Ser Gly Lys Ala Ile Cys Lys Asn Gly Ile Ser Lys Arg Thr
20           25           30

Phe Glu Glu Ile Lys Glu Glu Ile Ala Ser Cys Gly Asp Val Ala Lys
35           40           45

Ala Ile Ile Asn Leu Ala Val Tyr Gly Lys Ala Gln Asn Arg Ser Tyr
50           55           60

Glu Arg Leu Ala Leu Leu Val Asp Thr Val Gly Pro Arg Leu Ser Gly
65           70           75           80

Ser Lys Asn Leu Glu Lys Ala Ile Gln Ile Met Tyr Gln Asn Leu Gln
85           90           95

Gln Asp Gly Leu Glu Lys Val His Leu Glu Pro Val Arg Ile Pro His
100          105          110

```



Trp Glu Arg Gly Glu Glu Ser Ala Val Met Leu Glu Pro Arg Ile His  
 115 120 125  
 Lys Ile Ala Ile Leu Gly Leu Gly Ser Ser Ile Gly Thr Pro Pro Glu  
 130 135 140  
 Gly Ile Thr Ala Glu Val Leu Val Val Thr Ser Phe Asp Glu Leu Gln  
 145 150 155 160  
 Arg Arg Ala Ser Glu Ala Arg Gly Lys Ile Val Val Tyr Asn Gln Pro  
 165 170 175  
 Tyr Ile Asn Tyr Ser Arg Thr Val Gln Tyr Arg Thr Gln Gly Ala Val  
 180 185 190  
 Glu Ala Ala Lys Val Gly Ala Leu Ala Ser Leu Ile Arg Ser Val Ala  
 195 200 205  
 Ser Phe Ser Ile Tyr Ser Pro His Thr Gly Ile Gln Glu Tyr Gln Asp  
 210 215 220  
 Gly Val Pro Lys Ile Pro Thr Ala Cys Ile Thr Val Glu Asp Ala Glu  
 225 230 235 240  
 Met Met Ser Arg Met Ala Ser His Gly Ile Lys Ile Val Ile Gln Leu  
 245 250 255  
 Lys Met Gly Ala Lys Thr Tyr Pro Asp Thr Asp Ser Phe Asn Thr Val  
 260 265 270  
 Ala Glu Ile Thr Gly Ser Lys Tyr Pro Glu Gln Val Val Leu Val Ser  
 275 280 285  
 Gly His Leu Asp Ser Trp Asp Val Gly Gln Gly Ala Met Asp Asp Gly  
 290 295 300  
 Gly Gly Ala Phe Ile Ser Trp Glu Ala Leu Ser Leu Ile Lys Asp Leu  
 305 310 315 320  
 Gly Leu Arg Pro Lys Arg Thr Leu Arg Leu Val Leu Trp Thr Ala Glu  
 325 330 335  
 Glu Gln Gly Gly Val Gly Ala Phe Gln Tyr Tyr Gln Leu His Lys Val  
 340 345 350  
 Asn Ile Ser Asn Tyr Ser Leu Val Met Glu Ser Asp Ala Gly Thr Phe  
 355 360 365  
 Leu Pro Thr Gly Leu Gln Phe Thr Gly Ser Glu Lys Ala Arg Ala Ile  
 370 375 380  
 Met Glu Glu Val Met Ser Leu Leu Gln Pro Leu Asn Ile Thr Gln Val  
 385 390 395 400  
 Leu Ser His Gly Glu Gly Thr Asp Ile Asn Phe Trp Ile Gln Ala Gly

405	410	415
Val Pro Gly Ala Ser Leu Leu Asp Asp Leu Tyr Lys Tyr Phe Phe Phe		
420	425	430
His His Ser His Gly Asp Thr Met Thr Val Met Asp Pro Lys Gln Met		
435	440	445
Asn Val Ala Ala Ala Val Trp Ala Val Val Ser Tyr Val Val Ala Asp		
450	455	460
Met Glu Glu Met Leu Pro Arg Ser		
465	470	

## (2) INFORMATION FOR SEQ ID NO:5:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 1076 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:5:

CAGAAGTTCA AGGGCCCCCG GCCTCCTGCG CTCCTGCCGC CGGGACCCTC GACCTCCTCA	60
GAGCAGCCGG CTGCCGCCCC GGAAGATGG CGAGGAGGAG CCGCCACCGC CTCCTCCTGC	120
TGCTGCTGCG CTACCTGGTG GTCGCCCTGG GCTATCATAA GGCCTATGGG TTTTCTGCCC	180
CAAAAGACCA ACAAGTAGTC ACAGCAGTAG AGTACCAAGA GGCTATTTTA GCCTGCAAAA	240
CCCCAAAGAA GACTGTTTCC TCCAGATTAG AGTGGAAGAA ACTGGGTCGG AGTGTCTCCT	300
TTGTCTACTA TCAACAGACT CTTCAAGGTG ATTTTAAAAA TCGAGCTGAG ATGATAGATT	360
TCAATATCCG GATCAAAAAT GTGACAAGAA GTGATGCGGG GAAATATCGT TGTGAAGTTA	420
GTGCCCCATC TGAGCAAGGC CAAAACCTGG AAGAGGATAC AGTCACTCTG GAAGTATTAG	480
TGGCTCCAGC AGTTCCATCA TGTGAAGTAC CCTCTTCTGC TCTGAGTGGA ACTGTGGTAG	540
AGCTACGATG TCAAGACAAA GAAGGGAATC CAGCTCCTGA ATACACATGG TTTAAGGATG	600
GCATCCGTTT GCTAGAAAAT CCCAGACTTG GCTCCCAAAG CACCAACAGC TCATACACAA	660
TGAATACAAA AACTGGAACCT CTGCAATTTA ATACTGTTTC CAAACTGGAC ACTGGAGAAT	720
ATTCCTGTGA AGCCCGCAAT TCTGTTGGAT ATCGCAGGTG TCCTGGGAAA CGAATGCAAG	780

```

TAGATGATCT CAACATAAGT GGCATCATAG CAGCCGTAGT AGTTGTGGCC TTAGTGATTT      840
CCGTTTGTGG CCTTGGTGTA TGCTATGCTC AGAGGAAAGG CTACTTTTCA AAAGAAACCT      900
CCTTCCAGAA GAGTAATTCT TCATCTAAAG CCACGACAAT GAGTGAAAAT GATTTCAAGC      960
ACACAAAATC CTTTATAATT TAAAGACTCC ACTTTAGAGA TACACCAAAG CCACCGTTGT     1020
TACACAAGTT ATTAACTAT TATAAACTC AAAAAAAAAA AAAAAAAAAA AAAAAA      1076

```

## (2) INFORMATION FOR SEQ ID NO:6:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 298 amino acids
- (B) TYPE: amino acid
- (C) STRANDEDNESS:
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: protein

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:6:

```

Met Ala Arg Arg Ser Arg His Arg Leu Leu Leu Leu Leu Arg Tyr
1           5           10           15
Leu Val Val Ala Leu Gly Tyr His Lys Ala Tyr Gly Phe Ser Ala Pro
20          25          30
Lys Asp Gln Gln Val Val Thr Ala Val Glu Tyr Gln Glu Ala Ile Leu
35          40          45
Ala Cys Lys Thr Pro Lys Lys Thr Val Ser Ser Arg Leu Glu Trp Lys
50          55          60
Lys Leu Gly Arg Ser Val Ser Phe Val Tyr Tyr Gln Gln Thr Leu Gln
65          70          75          80
Gly Asp Phe Lys Asn Arg Ala Glu Met Ile Asp Phe Asn Ile Arg Ile
85          90          95
Lys Asn Val Thr Arg Ser Asp Ala Gly Lys Tyr Arg Cys Glu Val Ser
100         105         110
Ala Pro Ser Glu Gln Gly Gln Asn Leu Glu Glu Asp Thr Val Thr Leu
115         120         125
Glu Val Leu Val Ala Pro Ala Val Pro Ser Cys Glu Val Pro Ser Ser
130         135         140
Ala Leu Ser Gly Thr Val Val Glu Leu Arg Cys Gln Asp Lys Glu Gly
145         150         155         160

```

Asn Pro Ala Pro Glu Tyr Thr Trp Phe Lys Asp Gly Ile Arg Leu Leu  
 165 170 175  
 Glu Asn Pro Arg Leu Gly Ser Gln Ser Thr Asn Ser Ser Tyr Thr Met  
 180 185 190  
 Asn Thr Lys Thr Gly Thr Leu Gln Phe Asn Thr Val Ser Lys Leu Asp  
 195 200 205  
 Thr Gly Glu Tyr Ser Cys Glu Ala Arg Asn Ser Val Gly Tyr Arg Arg  
 210 215 220  
 Cys Pro Gly Lys Arg Met Gln Val Asp Asp Leu Asn Ile Ser Gly Ile  
 225 230 235 240  
 Ile Ala Ala Val Val Val Val Ala Leu Val Ile Ser Val Cys Gly Leu  
 245 250 255  
 Gly Val Cys Tyr Ala Gln Arg Lys Gly Tyr Phe Ser Lys Glu Thr Ser  
 260 265 270  
 Phe Gln Lys Ser Asn Ser Ser Ser Lys Ala Thr Thr Met Ser Glu Asn  
 275 280 285  
 Asp Phe Lys His Thr Lys Ser Phe Ile Ile  
 290 295

## (2) INFORMATION FOR SEQ ID NO:7:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 2522 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: cDNA

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:7:

GAAAGGTTGT GTAGCTTGCC CTGGTTGCAT AGTTAAACGA GGGCTAGAAA CAGGACTAGG 60  
 AGTCAGGCCT GTCCAGCTGG AAAACTTGGG TTTTCTAGAA GGGGTACCCT GGCCTCCTGC 120  
 GGAGCCTGCT GTGGGACTCT GCAGAACACA ATTCAAGGCC AGACTGAACA CTAGCCTGAA 180  
 CCTGCCCTGA GAATCCCTCT AAGCCGACCT ACTCCACAGC TGTCTGACT GTGTAAGCGA 240  
 GATGATGATT AGTGATCAGA CGAAAGGATT CCTGTCATTG GTAACCCTCT CAAAGTATTT 300  
 GGAAAACAGT TCAATTTTCA TCTATTTTCA AAGCACGCCG TGGTGTCTAT TGAGGCTCAC 360  
 CTGCATTGAA TTCCTTCCTT TTTATGTTGC GATCTCCCAA GATTGCATTG TGGAGTGTTC 420

TCGAATCCAT TTTGAAATCC CCGTGCGTGC GCTATGCAGG CCTCAGTCTT TTTCCATTCC	480
ATTCTTAACT CTACTTTCGA CGGAAGCAGT GTTTTACCCC GACACTGGCT TGCCTAGGAC	540
CTTGTGCTCT GCACAACTAG CAGGGCCCGG CAGGATGTAC TGAATTCTTG CTCTCGTGTC	600
CAGCTGGACG GTGATGGCTT TCAAGTCCTT GGCTGTTGGG AGCTTACTAT AAATGTTTCGT	660
CTTGGCTACA AACTCTCCAC TCTTTCCTCG GCACTCTCTC AGCATTGCCA CCACTGTCTT	720
TCCTCTTGGC CAACTGTTTT CTTTACTTAG GCTTTCCTT GCTAGAAAGT CCAGGTAACT	780
TTCTCCACGG GACCTGGTTT CCTTCGCACA TCCCAGCTGG CCTCGAGGAA AGGTAGCTCT	840
TCCAAATCAG AGAATCTGGA TGCTGGGCTG GGCTCTGCAC CAACCAGCTG GGCCGCTTCA	900
CCCCTGGGC CCCAACTAC TCATCTGTGA AGCGAAGGCA CCGCGCTTGA TGCCTTCTGC	960
AACGTTCTTC AGTTTGGAAT TCCTTCTGTT TCGTTGGGGA TATTTACGG CCTCTTCTCA	1020
AGGTTGCACT TTTGCCAGCT GCCAGGATC GTCTCAAAAC AGGTTCTTAG TGCATTCTA	1080
GCTTGAGCTG CTGTCTTGAA AGTAGTACAT TCCTTTTCTT GCCAACTTTT TTCTGAGAAA	1140
GTTTTTGAAT GCACACGTGC ACCCAACAGA GTGAGAGTGG CTGTTAAGAG AGAGGGCGCC	1200
ATTTCTTTG CCCTCCAGCC TGTCCCTGTG CACCCTGGAG GGGCCCGTTT TTTCCACCGC	1260
TTAGATAAAA TCTAGGGCAA GTTCCTGAAC TTCTCTTGTC TCTCTCAGGT AACAAAAATT	1320
CTTTTGGGCT CCTTTAGTCA CAAAGATATT CACGATTTC GGTATTAAAG TGCCAGCCC	1380
TGGGTGATTG TCAAAATTCT GAACTTGATT TAAAGTGGCA CCTCCTCTCA CAGTCTTCGG	1440
GAGGGAGAGA CCGGAGCCAG GAGTGCAGCG TGTTTGCTGG GGTCTGTCGT GGCCCACTCC	1500
ACACCTGCTG GGTGGATCCG GCTGGTGCCC CATGGGCGCC TCTGAGATGC CCCTCCCCAC	1560
CCCATCAGTG GCGCTGTCTC ACCTGCAGGC TGTTCTCACA GGTGGTCCCC CCTCACTCCT	1620
CCTGCAGCCC CAGTTCCTGG CTGTTTATTC TTATTGGGAC CCGTCACCCT CCTGGAGGCG	1680
GTCCAGCCG AGCCCCCTTA AGACAGCACC AGGCTGGCTC CACTTGGCCC CCGCTGGTTC	1740
AGGGAAGTGC TGCTGCAGCC GTTTAGTTTG ACAAAGGAGG CAGCGAGGCC GTCTCATTGG	1800
TAGCCCTCTC CTGGCTTGCC CAGCCACCAC CTCACCTCGA TTCCTCCCAG GCCTGGGTCC	1860
AGCACCAGCC TAGGAAGAGG GTGCCCCATG CTGTCTAGCT CTTCTTCGGG ATGGGGGGCT	1920
CCAGGTTCCCT TGGTATTTTG CTTTGGCCTT TGGAGCCTCA GTCAAACTG AGGAAAGGTG	1980
TCATTTTCAC ATCTCGTCAC ACGTACAGTG ACTGCAACTA AAAGCACAGG CTTTGTAGAA	2040
ACAGACATGG GTTCAGGCCC CAGCTCCACC ATTCACAAGG TGTGTGGCTT CCTGCAAGGT	2100

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ACCTTCATCT CTGAGTTACC TGACTCCATC TGAGTTTCCT TCTTGTA AAA CTGGCATCCA      2160
TGAAAGTGGC TACCTCGAAG GCGGTGAAGA TGAAATGAGG TGGAAAGTAG GTAGCCCCCG      2220
AATGAGGGAA GCATTGAGTG AGAGCTGGCC CTCTGACCCT TCTAAAAGAA CACAGCCAAC      2280
TTTTTAAACT GTCTTCCAG AAAGAGATGG AAAACTTCGA AGCCCCCTTC CACTGCCTTG      2340
CCAAGCAGTT CCACCAGCTG TACCGGGAGA AGGTGGAGGT TTTCCGGGCC CTGGCATGAC      2400
GAGCTGGAGC AGATCGTGCT GCACAACCGG AGAAGACAGA ATTACCTCTG CTCTTTTAAT      2460
ATATAATGAT GGCTTTAAAT AAAATTAGGA GAAAATGTCA AAAAAAAAAA AAAAAAAAAA      2520
AA                                                                                   2522

```

## (2) INFORMATION FOR SEQ ID NO:8:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 113 amino acids
- (B) TYPE: amino acid
- (C) STRANDEDNESS:
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: protein

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:8:

```

Met Met Ile Ser Asp Gln Thr Lys Gly Phe Leu Ser Leu Val Thr Leu
1           5           10           15
Ser Lys Tyr Leu Glu Asn Ser Ser Ile Phe Ile Tyr Phe Arg Ser Thr
20           25           30
Pro Trp Cys Leu Leu Arg Leu Thr Cys Ile Glu Phe Leu Pro Phe Tyr
35           40           45
Val Ala Ile Ser Gln Asp Cys Ile Val Glu Cys Phe Arg Ile His Phe
50           55           60
Glu Ile Pro Val Arg Ala Leu Cys Arg Pro Gln Ser Phe Ser Ile Pro
65           70           75           80
Phe Leu Thr Leu Leu Ser Thr Glu Ala Val Phe Tyr Pro Asp Thr Gly
85           90           95
Leu Pro Arg Thr Leu Cys Ser Ala Gln Leu Ala Gly Pro Gly Arg Met
100          105          110
Tyr

```

## (2) INFORMATION FOR SEQ ID NO:9:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 1962 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: cDNA

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:9:

```

CCCCGGCCCC AGCCTTCTCC AGAACCCTTG CTACCCACGA CTAAGCCCCG AACAACTCTGC      60
CCTTGGGCTT GTTCTCTTCG CAGTTGTCGG CCCTGGGCCC GGAGCTGGAG TCCCAGACTC      120
ATAGGTCCCG GCCCAGCCCC CGAAGAGCCG CCTCAGCCGG GGGGAGTTGC TCGGACTCAA      180
ACGTCCAGTC CTCGTGCGAC CGCGCTGGGT CGGAAGTGAG CAGGCTGAGG CCACCATGGA      240
GCAGTGTGCG TCGGTGGAGA GAGAGCTGGA CAAGGTCCTG CAGAAGTTCC TGACCTACGG      300
GCAGCACTGT GAGCGGAGCC TGGAGGAGCT GCTGCACTAC GTGGGCCAGC TGCGGGCTGA      360
GCTGGCCAGC GCAGCCCTCC ARGGGACCCC TCTCTCAGCC ACCCTCTCTC TGGTGATGTC      420
ACAGTGCTGC CGGAAGATCA AAGATACGGT GCAGAACTG GCTTCGGAMC ATAAGGACAT      480
TCACAGCAGT GTATCCCAG TGGGCAAAGC CATTGACAGG AACTTCGACT CTGAGATCTG      540
TGGTGTGTG TCAGATGCGG TGTGGGACGC GCGGGAACAG CAGCAGCAGA TCCTGCAGAT      600
GGCCATCGTG GAACACCTGT ATCAGCAGGG CATGCTCAGC GTGGCCGAGG AGCTGTGCCA      660
GGAATCAACG CTGAATGTGG ACTTGGATTT CAAGCAGCCT TTCCTAGAGT TGAATCGAAT      720
CCTGGAAGCC CTGCACGAAC AAGACCTGGG TCCTGCGTTG GAATGGGCCG TCTCCCACAG      780
GCAGCGCTG CTGGAACTCA ACAGCTCCCT GGAGTTCAAG CTGCACCGAC TGCACTTCAT      840
CCGCTCTTG GCAGGAGGCC CCGCGAAGCA GCTGGAGGCC CTCAGCTATG CTCGGCACTT      900
CCAGCCCTTT GCTCGGCTGC ACCAGCGGGA GATCCAGGTG ATGATGGGCA GCCTGGTGTA      960
CCTGCGGCTG GGCTTGGAGA AGTCACCCTA CTGCCACCTG CTGGACAGCA GCCACTGGGC     1020
AGAGATCTGT GAGACCTTTA CCCGGGACGC CTGTTCCCTG CTGGGGCTTT CTGTGGAGTC     1080
CCCCCTTAGC GTCAGCTTTG CCTYTGGCTG TGTGGCGCTG CCTGTGTTGA TGAACATCAA     1140
GGCTGTGATT GAGCAGCGGC AGTGCCTGG GGTCTGGAAT CACAAGGACG AGTTACCGAT     1200

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GAGATTGAAC TAGGCATGAA GTGCTGGTAC CACTCCGTGT TCGCTTGCCC CATCCTCCGC 1260  
 CAGCAGACGT CAGATTCCAA CCCTCCCATC AAGCTCATCT GTGGCCATGT TATCTCCCGA 1320  
 GATGCACTCA ATAAGCTCAT TAATGGAGGA AAGCTGAAGT GTCCCTACTG TCCCATGGAG 1380  
 CAGAACCCCG CAGATGGGAA ACGCATCATA TTCTGATTCC TACCTGGAAG GAATTTTGTT 1440  
 GAAAGGGGTT TTCACCTGTG AGCCTTGGTC TGTCTCGGTA GGGTGGTCAA CTTCAGTGGA 1500  
 CTGTGGTTGG TTTCAGAGCG CCTGGCTGAG GAGTTCCACT GAGGGGAGCA CTGGAGCAGC 1560  
 CCTTTGGCAG AGGCTGAGGA GGGAGATGGA CCAGCCCACG CCTGGCACCT GGCTCCATGG 1620  
 CATAAGGAAA GGGAGATGCT GGCCTCTGTG CTCCTGCTGT CTTTTCCTGT TTCTGTTTGC 1680  
 GTTTGACTTA GTAGCAACCG ACAGAGTGGC AAGGGATTTG GTCTTCAGCA GTAGACATCC 1740  
 TTCCACCCCT GCCCTCAGCC AAGTCTCTTG CTGCCATGCC AATGCTATGT CCACCCTTGC 1800  
 CCCTCGGCCC AAGAGTGTC AGCGGTGGCC CACYTYTTCC TCCCACTACA GCCTCAACAG 1860  
 TATGTACCAT CTCCCACTGT AAATAGTCCC AGTTAGAACG GAATGCCGTT GTTTTATAAC 1920  
 TTTGAACAAA TGTATTTACT GCCAAAAAAA AAAAAAAAAA AA 1962

## (2) INFORMATION FOR SEQ ID NO:10:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 325 amino acids
- (B) TYPE: amino acid
- (C) STRANDEDNESS:
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: protein

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:10:

Met Glu Gln Cys Ala Cys Val Glu Arg Glu Leu Asp Lys Val Leu Gln  
 1 5 10 15  
 Lys Phe Leu Thr Tyr Gly Gln His Cys Glu Arg Ser Leu Glu Glu Leu  
 20 25 30  
 Leu His Tyr Val Gly Gln Leu Arg Ala Glu Leu Ala Ser Ala Ala Leu  
 35 40 45  
 Gln Gly Thr Pro Leu Ser Ala Thr Leu Ser Leu Val Met Ser Gln Cys  
 50 55 60  
 Cys Arg Lys Ile Lys Asp Thr Val Gln Lys Leu Ala Ser Xaa His Lys  
 65 70 75 80



```

Asp Ile His Ser Ser Val Ser Arg Val Gly Lys Ala Ile Asp Arg Asn
      85                      90                      95

Phe Asp Ser Glu Ile Cys Gly Val Val Ser Asp Ala Val Trp Asp Ala
      100                      105                      110

Arg Glu Gln Gln Gln Gln Ile Leu Gln Met Ala Ile Val Glu His Leu
      115                      120                      125

Tyr Gln Gln Gly Met Leu Ser Val Ala Glu Glu Leu Cys Gln Glu Ser
      130                      135                      140

Thr Leu Asn Val Asp Leu Asp Phe Lys Gln Pro Phe Leu Glu Leu Asn
      145                      150                      155                      160

Arg Ile Leu Glu Ala Leu His Glu Gln Asp Leu Gly Pro Ala Leu Glu
      165                      170                      175

Trp Ala Val Ser His Arg Gln Arg Leu Leu Glu Leu Asn Ser Ser Leu
      180                      185                      190

Glu Phe Lys Leu His Arg Leu His Phe Ile Arg Leu Leu Ala Gly Gly
      195                      200                      205

Pro Ala Lys Gln Leu Glu Ala Leu Ser Tyr Ala Arg His Phe Gln Pro
      210                      215                      220

Phe Ala Arg Leu His Gln Arg Glu Ile Gln Val Met Met Gly Ser Leu
      225                      230                      235                      240

Val Tyr Leu Arg Leu Gly Leu Glu Lys Ser Pro Tyr Cys His Leu Leu
      245                      250                      255

Asp Ser Ser His Trp Ala Glu Ile Cys Glu Thr Phe Thr Arg Asp Ala
      260                      265                      270

Cys Ser Leu Leu Gly Leu Ser Val Glu Ser Pro Leu Ser Val Ser Phe
      275                      280                      285

Ala Xaa Gly Cys Val Ala Leu Pro Val Leu Met Asn Ile Lys Ala Val
      290                      295                      300

Ile Glu Gln Arg Gln Cys Thr Gly Val Trp Asn His Lys Asp Glu Leu
      305                      310                      315                      320

Pro Met Arg Leu Asn
      325

```

## (2) INFORMATION FOR SEQ ID NO:11:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 745 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:11:

```

AAAAACACAA AACCCCGTAA AATCACAAAG AAAATCCAAC ACCAAAGGCG CAGAAGCCGG      60
CTGGCCGTGG TGGGGGCAGC GTAGGCGTAG CATCCCTCTC CTCTCACTTA GCCTGTTGAC      120
TCTTGTTATT ATCATGATAT TCACAAAACG CCGCATGTTT AAAAAGTCAT AGATGTCATC      180
TTCTCTCTGC CCCAGGGAG GAAAGCCACC TTCTCTTGCC CCTTGGCCCC TTTGTCAGGG      240
GCCAGGGGTC TGCCGGGTGG GGGTGCCAAC AGGCCTGGCC CTTTCCTCCC CTGCATCCAG      300
CCATGGGGGC CTCTGCGATT GCCGGAAGGT TGCATGGCTG GTCCCAGGGC CAGCACAGGC      360
CCGAGGCCGG GCTGCCTGGT TTTATTTTAA TTAACTTTA TTTTCTGTTT TATGAGTGTG      420
TGTCGCCCCA CCCCCACCC CTTAGTGTT AAGTGGGGAG CCCTGGGGGA GTCTCTCCTG      480
CCTCCCAGCC TCTCCAAGA CCTCCCCCT CGTCACCAGC CATCCCTCTG GACCAGGCAG      540
AGGGCGGACC GGGTGGGCAG GGGCCTGAGG GTGGCTCGGG CCAGCCCACC AGCCAATGGA      600
CCCCTCCTCA GGCCGCCAGT GTCGCCCTGC CCCTTTTAA AACAAAATGC CCTCGTTTGT      660
AAACCCTTAG ACGCTTGAGA ATAAACCCCT TCCTTTTCTT CCAAAAAAAAA AAAAAAAAAA      720
AAAAAAAAAA AAAAAAAAAA AAAAAA                                     745

```

(2) INFORMATION FOR SEQ ID NO:12:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 114 amino acids
  - (B) TYPE: amino acid
  - (C) STRANDEDNESS:
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:12:

```

Met Ala Gly Pro Arg Ala Ser Thr Gly Pro Arg Pro Gly Cys Leu Val
1           5           10           15
Leu Phe Leu Phe Asn Phe Ile Phe Cys Phe Met Ser Val Cys Pro Pro
                20           25           30
Thr Pro Thr Pro Phe Ser Val Lys Trp Gly Ala Leu Gly Glu Ser Leu

```

35	40	45
Leu Pro Pro Ser Leu Ser Gln Asp Leu Pro Pro Arg His Gln Pro Ser		
50	55	60
Leu Trp Thr Arg Gln Arg Ala Asp Arg Val Gly Arg Gly Leu Arg Val		
65	70	75
Ala Arg Ala Ser Pro Pro Ala Asn Gly Pro Leu Leu Arg Pro Pro Val		
85	90	95
Ser Pro Cys Pro Phe Leu Lys Gln Asn Ala Leu Val Cys Lys Pro Leu		
100	105	110
Asp Ala		

## (2) INFORMATION FOR SEQ ID NO:13:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 1983 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: cDNA

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:13:

TGGCAATAGT GGTAGGGAA GGCTCCTTTG AGGAAGTGAA TTTTAGCTG AGACTTAAAG	60
AACAAATGAG ATTTAGCTAG AAAAATTGGA CATGCGATGC CAAGATGGCA TTTTAAAGA	120
ATAATAGTAA GCACAAAGGC CCTGTAGCAG GAGGGAGCTG ATTGTCCATA GTTCAGACAG	180
CAAAGAAGCT GATGATGCAG GTTGGGGTCA GACCGTGTTT GACTACAGAT AGGATGTTAA	240
GGGTTTTGGC TTTTAGGTT TTTGTTTAA TTCTAAAAGT AATGGAAAAT GTACTCCTTT	300
TGGTGGTGGT CTGAGAGAAG GTACATCATT AGAATGACAT TTTGAAAACA AACTCAGGC	360
TGCTCAGTAG AGAATGGCTT CAAAGGATTT AAAAGCAGAA GCAGAAGGAC ATATTAGAGA	420
AGGATTGTAT AGTTTCTGG TAAAAGATGA CAGTGAATTG TATGGGCGAT GGATTAGCCG	480
TGGAAGGTGT TGAGTATAAG TGGTCTCCAG CCAAACCTA TGGTACTGG AATAAGAGAG	540
TAGGAACCTT TCTCAGGCTT TATCTTTATC TATTCTTGTC AACAGTATGT ACATGTGTCC	600
CCCAGCCCCA AATAACTGTA CAGTTTAATG ATGTTCACTC TATACAGTTC CCAGAATCCA	660
TTGGAAATTG CTGTAACAGC ATATCCTCAA TGCCCATCAA TTCTCCACGT CCAACTTCTC	720

CATGGCCTCC TCTGCCTCTG CTGATCTGTG AACTTCCCAA GCCCCTTCCC CTACCTGCTT	780
TTGATTGGCT TTAACCTTTA CAATATCTTC ATTACTCCAA GTTTGTTCAG CATCCTTTTT	840
ATTTTCTTAA ATCATAGATT GATTTAGTTT ATTCTCTTTG CCATTTTGA ATCTCATTAT	900
TTCTGTTTCT CCTTGGTTAT TAGTGGCTCT GTTTTCCTTC AATGCCTCT TGTCTTTGAG	960
AAGCTCTTGT GATTCTTTTA GGGCCATTG CCATTTGATT GGTTTGTCTT CCTTTTCCCT	1020
ATAAGCTTTA AATATGGCAT TATAGTTTTA TCCCCTTTC TCTTCTTTAG GTACAACTGC	1080
AGACACTTTG CTCTTCCAAG GTTACTAAGC AGTGTCTGAC ACAATGTAGA AGCTCAACAA	1140
ATATTGGTTA AATTTATTTT TCTATTGAT TGTTTCTGCT TTGATGACAT CACTTAAAT	1200
GTTTCTTGTA CACACCCTGT TTTCTACTGA TATATGTATG TGTATGGCTA CCTGAATCCA	1260
GGTTTCTTCT AGGAATATAC AGAAAGTAAT TGATTTCTCT GTGGATCTCT AACAGTGACA	1320
AGAATTTTCA CCTATGCCTG TGAGAATACC TTCAAAGTA TTGGGTGCTC ATCATAAACA	1380
CACATCAGTT TAACAACTC TTATGGATGC ATTGACTTTC CCAGTTAGTT GCTAGATGAC	1440
TTGCGATGAT TTGCATAATG GGTCTCAGTT TCCATATCTG TTAAATGGCA ATAATCAGAG	1500
AATTTTAAAA AATTTAAGGA CACCTGGAAA GCTTGAAAGA TCCCTAGAAA GCATGTGTTT	1560
ATTCCACATA GTGGGAACTA TGCTAGATTC CCAAAGACAC AAAGACAACT AAGACAACTT	1620
AGAATAAGAA GGAAAAGAGA ATGATTCTGT GCAATGATCC CCTGAAGCT CCAGTTGAAA	1680
GTCAGAGTAT TGCCCTGGAT TGGAAGTAGT CTCCAACTG ACATCATTTT CTTTTTCGAA	1740
CCATATCTGG CCTGTCTCTC TTGCCAGTTG CATATTAAAG GTAACAGATT TGAAAAATGT	1800
TGGAATAAAA GCTCTAGTTA GGTGTGGTGG CACACACCTG CCATCCCAGC TACTGGAGAG	1860
TCTGAGACTC GATGATTGTT TCAGCCCAAG AGTTGGAGGT TGAGTGAGC TATGATGGCA	1920
CCACTGCACT CCACTCTGTG TGACAGAGCG AAGACCTTGT CTCTAAGGAA AAAAAAAAAA	1980
AAA	1983

## (2) INFORMATION FOR SEQ ID NO:14:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 115 amino acids
- (B) TYPE: amino acid
- (C) STRANDEDNESS:
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: protein

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:14:

```

Met Thr Val Asn Cys Met Gly Asp Gly Leu Ala Val Glu Gly Val Glu
1           5           10           15

Tyr Lys Trp Ser Pro Ala Lys Leu Tyr Gly Tyr Trp Asn Lys Arg Val
          20           25           30

Gly Thr Leu Leu Arg Leu Tyr Leu Tyr Leu Phe Leu Ser Thr Val Cys
          35           40           45

Thr Cys Val Pro Gln Pro Gln Ile Thr Val Gln Phe Asn Asp Val His
          50           55           60

Ser Ile Gln Phe Pro Glu Ser Ile Gly Asn Cys Cys Asn Ser Ile Ser
65           70           75           80

Ser Met Pro Ile Asn Ser Pro Arg Pro Thr Ser Pro Trp Pro Pro Leu
          85           90           95

Pro Leu Leu Ile Cys Glu Leu Pro Lys Pro Leu Pro Leu Pro Ala Phe
          100          105          110

Asp Trp Leu
          115

```

## (2) INFORMATION FOR SEQ ID NO:15:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 1046 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: double
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:15:

```

GGGCTTAGTT AGGAGCTATG GCTAAACATC ATCCTGATTT GATCTTTTGC CGCAAGCAGG      60
CTGGTGTTGC CATCGGAAGA CTGTGTGAAA AATGTGATGG CAAGTGTGTG ATTTGTGACT      120
CCTATGTGCG TCCCTGCACT CTGGTGCGCA TATGTGATGA GTGTAACAT GGATCTTACC      180
AGGGGCGCTG TGTGATCTGT GGAGGACCTG GGGTCTCTGA TGCCTATTAT TGTAAGGAGT      240
GCACCATCCA GGAGAAGGAC AGAGATGGCT GCCCAAAGAT TGTCAATCTG GGGAGCTCTA      300
AGACAGACCT CTTCTATGAA CGCAAAAAAT ACGGCTTCAA GAAGARGTGA TTGGTGGGTG      360
CCCCCTTCCT CCCCCAACA TCAGTCTGCT GCAGCTGCCA GAAAACATGC CTACTACTAC      420

```

```

CAGCAGAAAG GGAGCAGAGC CCAGAGCATC ACCAGGAGTG CCTGCTAGTG TACTGGCAGC      480
TTGCCACCCC CTCCTCTCCC TTCACCCAGA CACGTGGTAG GGATGGAAAA GGATTCTTCA      540
CAGAGCACTC TGGCACACCA TATCGGAGAA AACTTGATAG ATTAGTTAAT GGTTTTCTT      600
GAATTCGAGA AGCATAGATC TGTTCTCCAT ATTGGTATGT TCTCCCTCAA CCAAGATCTT      660
CTAAAAAGAA ATAATATTTT AGTCTTCTGC TTGAGGAACT GACTGTGAAG CGACGCCAG      720
TGAAAAACAT GTTCTTGCAG CAGCTCTGGT GGCAGCTGTC CTTGAGGAAC CTTTGGTGTG      780
TGGTGGGAAG CTATCAGAAC AAGAAATGTA GGCATTTCCTT GTTTTTTTGG GGGGGGGGGG      840
TGGGGGGGCA GGGCTCTGCC CTCTTGAAAG GCATTTACTT GTTTAACACT TGTCCAGCTA      900
CAGTGGGGTA CAGTAGCTGG CTATTCACAG GCATCATCAT AGCCCACTAG TCTCATATTA      960
TTTTCCTTTT GAGAAATTGG AACTCTTTC TGTTGCTATT ATATTAATAA AGTTGGTGTT     1020
TATTTTCTGG TAAAAA      AAAAAA      1046

```

## (2) INFORMATION FOR SEQ ID NO:16:

- (i) SEQUENCE CHARACTERISTICS:
- (A) LENGTH: 110 amino acids
  - (B) TYPE: amino acid
  - (C) STRANDEDNESS:
  - (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:16:

```

Met Ala Lys His His Pro Asp Leu Ile Phe Cys Arg Lys Gln Ala Gly
1           5           10           15

Val Ala Ile Gly Arg Leu Cys Glu Lys Cys Asp Gly Lys Cys Val Ile
          20           25           30

Cys Asp Ser Tyr Val Arg Pro Cys Thr Leu Val Arg Ile Cys Asp Glu
          35           40           45

Cys Asn Tyr Gly Ser Tyr Gln Gly Arg Cys Val Ile Cys Gly Gly Pro
          50           55           60

Gly Val Ser Asp Ala Tyr Tyr Cys Lys Glu Cys Thr Ile Gln Glu Lys
          65           70           75           80

Asp Arg Asp Gly Cys Pro Lys Ile Val Asn Leu Gly Ser Ser Lys Thr
          85           90           95

```

Asp Leu Phe Tyr Glu Arg Lys Lys Tyr Gly Phe Lys Lys Xaa  
 100 105 110

## (2) INFORMATION FOR SEQ ID NO:17:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 1814 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: double
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: cDNA

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:17:

```

ATCTTGCAGT GGGCCTCTGT CCCAAAAACA AGCAGAATTT TTTCTTTCTC AACAGGCTTC      60
TTTGCTAAAG AATGATGAGA CTAAGGCCCT CACTCCAGCT TCCTTGCAGA AGGAATTAAA      120
CAATTTGTTG AAATTTAATC CTGATTTTGC TGAAGCGCAT TATCTCAGCT ACTTAAACAA      180
CCTCCGTGTC CAAGATGTTT TCAGTTCAAC ACACAGTCTC CTCCATTATT TTGATCGTCT      240
GATTCTTACC GGAGCCGAAA GCAAAAGTAA TGGGGAAGAR GGCTATGGCC GGAGCTTGAG      300
ATACCCCGCT CTGAATCTTG CCGCCCTGCA CTGCCGCTTC GGTCACATC AACAGGCAGA      360
GCTCGCCCTG CAGGARGCAA TTAGGATTGC CCAGGARTCC AACGATCAGG TGTGTCTCCA      420
GCACTGTTTG AGCTGGCTTT ATGTGCTGGG GCAGAAGAGA TCCGATAGCT ATGTTCTGCT      480
GGAGCATTCT GTGAAGAAGG CAGTACATTT TGGGTTACCG TACCTCGCCT CCCTGGGAAT      540
ACAGTCCCTT GTTCAACAGA GAGCTTTTGC TGGGAAGACG GCAAACAAGC TGATGGATGC      600
CCTAAAGGAC TCCGACYTCC TGCACTGGAA ACACAGCCTG TCAGAGCTCA TCGATATCAG      660
CATCGCACAG AAAACGGCCA TCTGGAGGCT GTATGGCCGC AGCACCATGG CACTGCAACA      720
GGCCCAGATG TTGCTGAGCA TGAACAGCCT GGAGGCGGTG AATGCGGGCG TGCAGCAGAA      780
CAACACAGAG TCCTTTGCTG TCGCACTCTG CCACCTCGCA GAGCTACACG CGGAGCAGGG      840
CTGTTTGTCT GCAGCTTCTG AAGTGTTAAA GCACTTGAAG GAACGATTTC CGCCTAATAG      900
TCAGCACGCC CAGTTATGGA TGCTATGTGA TCAAAAAATA CAGTTTGACA GAGCAATGAA      960
TGATGGCAAA TATCATTTGG CTGATTCACCT TGTTACAGGA ATCACAGCTC TCAATAGCAT     1020
AGAGGGTGTT TATAGGAAAG CGGTTGTATT ACAAGCTCAG AACCAAATGT CAGAGGCACA     1080
TAAGCTTTTA CAAAAATTGT TGGTTCATTG TCAGAACTG AAGAACACAG AAATGGTGAT     1140

```

CAGTGTCCCTA CTGTCCGTGG CAGAGCTGTA CTGGCGATCT TCCTCCCCTA CCATCGCGCT 1200  
 GCCCATGCTC CTGCAGGCTC TGGCCCTCTC CAAGGAGTAC CGGTTACAGT ACTTGGCCTC 1260  
 TGAAACAGTG CTGAACTTGG CTTTGTGCGA GCTCATTCTT GGAATCCCAG AACAGGCCTT 1320  
 AAGTCTTCTC CACATGGCCA TCGAGCCCAT CTTGGCTGAC GGGGCTATCC TGGACAAAGG 1380  
 TCGTGCCATG TTCTTAGTGG CCAAGTGCCA GGTGGCTTCA GCAGCTTCCT ACGATCAGCC 1440  
 GAAGAAAGCA GAAGCTCTGG AGGCTGCCAT CGAGAACCTC AATGAAGCCA AGAACTATTT 1500  
 TGCAAAGGTT GACTGCAAAG AGCGCATCAG GGACGTCGTT TACTTCCAGG CCAGACTCTA 1560  
 CCATACCCTG GGAAGACCC AGGAGAGGAA CCGGTGTGCG ATGCTCTTCC GGCAGCTGCA 1620  
 TCAGGAGCTG CCCTCTCATG GGGTACCCTT GATAAACCAT CTCTAGAGAG GACATCCCTG 1680  
 CTGGGCTGCT GTGCAGAGTA TAAGATTTTG GACTTGTTCA TGTCCCCTCT CTCCCTATAA 1740  
 ATGATGTATT TGTGACACCC TATCTGTGCA ATAAACAGCA TTCTGATTAG TTTGTCTTAA 1800  
 AAAAAAAAAA AAAA 1814

## (2) INFORMATION FOR SEQ ID NO:18:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 357 amino acids
- (B) TYPE: amino acid
- (C) STRANDEDNESS:
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: protein

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:18:

Met Asp Ala Leu Lys Asp Ser Asp Xaa Leu His Trp Lys His Ser Leu  
 1 5 10 15  
 Ser Glu Leu Ile Asp Ile Ser Ile Ala Gln Lys Thr Ala Ile Trp Arg  
 20 25 30  
 Leu Tyr Gly Arg Ser Thr Met Ala Leu Gln Gln Ala Gln Met Leu Leu  
 35 40 45  
 Ser Met Asn Ser Leu Glu Ala Val Asn Ala Gly Val Gln Gln Asn Asn  
 50 55 60  
 Thr Glu Ser Phe Ala Val Ala Leu Cys His Leu Ala Glu Leu His Ala  
 65 70 75 80  
 Glu Gln Gly Cys Phe Ala Ala Ala Ser Glu Val Leu Lys His Leu Lys



85										90										95													
Glu	Arg	Phe	Pro	Pro	Asn	Ser	Gln	His	Ala	Gln	Leu	Trp	Met	Leu	Cys																		
			100						105					110																			
Asp	Gln	Lys	Ile	Gln	Phe	Asp	Arg	Ala	Met	Asn	Asp	Gly	Lys	Tyr	His																		
		115					120					125																					
Leu	Ala	Asp	Ser	Leu	Val	Thr	Gly	Ile	Thr	Ala	Leu	Asn	Ser	Ile	Glu																		
		130				135						140																					
Gly	Val	Tyr	Arg	Lys	Ala	Val	Val	Leu	Gln	Ala	Gln	Asn	Gln	Met	Ser																		
		145			150					155				160																			
Glu	Ala	His	Lys	Leu	Leu	Gln	Lys	Leu	Leu	Val	His	Cys	Gln	Lys	Leu																		
			165					170				175																					
Lys	Asn	Thr	Glu	Met	Val	Ile	Ser	Val	Leu	Leu	Ser	Val	Ala	Glu	Leu																		
		180					185					190																					
Tyr	Trp	Arg	Ser	Ser	Ser	Pro	Thr	Ile	Ala	Leu	Pro	Met	Leu	Leu	Gln																		
		195				200					205																						
Ala	Leu	Ala	Leu	Ser	Lys	Glu	Tyr	Arg	Leu	Gln	Tyr	Leu	Ala	Ser	Glu																		
		210				215				220																							
Thr	Val	Leu	Asn	Leu	Ala	Phe	Ala	Gln	Leu	Ile	Leu	Gly	Ile	Pro	Glu																		
		225			230				235					240																			
Gln	Ala	Leu	Ser	Leu	Leu	His	Met	Ala	Ile	Glu	Pro	Ile	Leu	Ala	Asp																		
			245				250					255																					
Gly	Ala	Ile	Leu	Asp	Lys	Gly	Arg	Ala	Met	Phe	Leu	Val	Ala	Lys	Cys																		
		260					265					270																					
Gln	Val	Ala	Ser	Ala	Ala	Ser	Tyr	Asp	Gln	Pro	Lys	Lys	Ala	Glu	Ala																		
		275				280					285																						
Leu	Glu	Ala	Ala	Ile	Glu	Asn	Leu	Asn	Glu	Ala	Lys	Asn	Tyr	Phe	Ala																		
		290				295					300																						
Lys	Val	Asp	Cys	Lys	Glu	Arg	Ile	Arg	Asp	Val	Val	Tyr	Phe	Gln	Ala																		
		305			310				315					320																			
Arg	Leu	Tyr	His	Thr	Leu	Gly	Lys	Thr	Gln	Glu	Arg	Asn	Arg	Cys	Ala																		
			325					330					335																				
Met	Leu	Phe	Arg	Gln	Leu	His	Gln	Glu	Leu	Pro	Ser	His	Gly	Val	Pro																		
			340				345					350																					
Leu	Ile	Asn	His	Leu																													
			355																														

(2) INFORMATION FOR SEQ ID NO:19:

- (i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 1540 base pairs  
 (B) TYPE: nucleic acid  
 (C) STRANDEDNESS: double  
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:19:

```

CAGAATGTCT TAACATGAGA ATTGAATTTC ATGATGTTTG GTTCCATTTA ATAGCGGACA      60
CCACCCCAAT CTCATGTTTT CCTGTTACCC TAAAACAGTG GAAGGAAACT GGGTGTTTGG      120
TAGACTTCTA AATCATGGTC TCTGACAATT TGAATCTGAG ATTCTCACCT CCATTTACTA      180
AAGAATCGTG ACTTAATTCA AATTGCACAG TAATCAGTAA AGTGAATACG TTTTAAAT      240
GGAATTTTCT CCCTTCAGCA AGCACTCATT AAGGAGTGAG GCTGAGTATT TTAAGATAGA      300
GTGAGATCTG TGAGTGATTG AAAGGTGATA TTTAAAAACT TGGATTTTCAT TCCAGTGTC      360
GGTTTGGGTT TTAAGTTCCT TTGGTCCAGG GAAGGGTCCA AGCAGCCACA GTTGCCCTAA      420
ATCTCCATCA TTAAGTCTTC CAGCAAGGTT AAGTGCAGTA TGGAAGGAGA AGGGGGAAGA      480
GGACGGTAAC GGCCCCACAC TCCAGGCTGA GAAAGAGTAA TTAGGAGGCC TGAGGAGGGG      540
CCGAGGAAAG GCTGTTGGGG TGTGCTGGGG TTGGTACCCG AGCGCCTTCC CCTCACCTCA      600
ACCAGAGAAG AGCATCCGGT TGCTTTTAA AGCTTTTAGC CTGCCCTAGC AAGGACAAAG      660
CATGTTAGAT TAGAGATGCT TCTGCTGATC GCAGGGGTTT TTATTTGAAA ACATCTATGA      720
TGGGGGTGGG GTGGGAGGAG ACAGGTTGTG GTTATGCAGG AAAATCTTGT CCTAAAAATA      780
TATGAGTTTG GGGGTAAGGG GTGGGATAGC CAAGCAAAAT CAGTAATTAT TTTAAATGA      840
ACATATGAAT TTTTATTAAC TTTTAGTTAA ATACAGATTT TACAACGAGG TCAGCATAAG      900
CCTAAATCTA TATAGAGGGC TAACTCAGGC ATTGTCTTGT TTATTTGTAG ACTGGATTAA      960
AAACAACCTG TCCTGTTTTG TCAGTCCCA GCTTCTTCGT TTAGAATAAA TTAGACCAAA      1020
AGAAGAAACG TGCTTGCTCT TGTATACCCG CAGAATGAAG TTAGTGTGT TAAACCGGA      1080
TTTTTTCATT TTAGTAGGTT CCGAAGAGTC CAGATGCTTG GTAGATGTTT AATACGTGAT      1140
TTTTTTTTTA ATTGAATGTG TTCATTAAAT ATCCTCCTTA ACATTTCTAG AAAGACTTCT      1200
TTCAATAAAT AATGGAATCT TAGAGGAAAA GTGGTTTTTT AAAAGCTAGG GAACTCCTCC      1260

```

ACTAAAAGTA ACCATTGGAA ACCTCGAATG AGGGCTAAAG TTTTAATCAT AAGAGAAAAG 1320  
 GCAGCATAAT GAAATGTGTA CACATACATA GTCAGTGGTC CATTTTAGGA AGCCAGTGGC 1380  
 GTCTGATAAA GAAATGTTAA GAGTAGTGAG GTTGAGGAAG GAAATTGTGG GGATTTGAAA 1440  
 TATTCTCTTT ATGTTGTTTC TCTTCTGAGT CATGGTAAAA CAATAAATTA TCATCTCTAG 1500  
 GTGGCAAAAA AAAAAAAAAA AAAAAAAAAA AAAAAAAAAA 1540

## (2) INFORMATION FOR SEQ ID NO:20:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 64 amino acids
- (B) TYPE: amino acid
- (C) STRANDEDNESS:
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: protein

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:20:

Met Lys Leu Leu Leu Leu Lys Pro Asp Phe Phe Ile Leu Leu Gly Ser  
 1 5 10 15  
 Glu Glu Ser Arg Cys Leu Val Asp Val Gln Tyr Val Ile Phe Phe Leu  
 20 25 30  
 Ile Glu Cys Val His Leu Lys Ser Ser Leu Thr Phe Leu Glu Arg Leu  
 35 40 45  
 Leu Ser Ile Asn Asn Gly Ile Leu Glu Glu Lys Trp Phe Phe Lys Ser  
 50 55 60

## (2) INFORMATION FOR SEQ ID NO:21:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 29 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: other nucleic acid

- (A) DESCRIPTION: /desc = "oligonucleotide"

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:21:

ANTGACGCCTT TAGCTAGTCC TTCTATCA

## (2) INFORMATION FOR SEQ ID NO:22:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 29 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: other nucleic acid

- (A) DESCRIPTION: /desc = "oligonucleotide"

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:22:

TNCAACAGTAT CAACCAGAAG TGCCAATC

29

## (2) INFORMATION FOR SEQ ID NO:23:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 29 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: other nucleic acid

- (A) DESCRIPTION: /desc = "oligonucleotide"

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:23:

GNAAACAGTAT TAAATTGCAG AGTTCCAG

29

## (2) INFORMATION FOR SEQ ID NO:24:

## (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 29 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

## (ii) MOLECULE TYPE: other nucleic acid

- (A) DESCRIPTION: /desc = "oligonucleotide"

## (xi) SEQUENCE DESCRIPTION: SEQ ID NO:24:

CNAATCATCAT CTCGCTTACA CAGTCAGG

29

## (2) INFORMATION FOR SEQ ID NO:25:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 29 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear
- (ii) MOLECULE TYPE: other nucleic acid
  - (A) DESCRIPTION: /desc = "oligonucleotide"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:25:

ANCGAGACAGA CCAAGGCTCA CAGGTGAA

29

(2) INFORMATION FOR SEQ ID NO:26:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 29 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear
- (ii) MOLECULE TYPE: other nucleic acid
  - (A) DESCRIPTION: /desc = "oligonucleotide"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:26:

GNGGACACACA CTCATAAAAC AGAAAATA

29

(2) INFORMATION FOR SEQ ID NO:27:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 29 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear
- (ii) MOLECULE TYPE: other nucleic acid
  - (A) DESCRIPTION: /desc = "oligonucleotide"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:27:

ANTAACCATAG AGTTTGGCTG GAGACCAC

29

(2) INFORMATION FOR SEQ ID NO:28:

- (i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 29 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

- (ii) MOLECULE TYPE: other nucleic acid
  - (A) DESCRIPTION: /desc = "oligonucleotide"

- (xi) SEQUENCE DESCRIPTION: SEQ ID NO:28:

ANTCTTCCGAT GGCAACACCA GCCTGCTT

29

- (2) INFORMATION FOR SEQ ID NO:29:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 29 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear
- (ii) MOLECULE TYPE: other nucleic acid
  - (A) DESCRIPTION: /desc = "oligonucleotide"

- (xi) SEQUENCE DESCRIPTION: SEQ ID NO:29:

GNTCACCATTT CTGTGTTCTT CAGTTTCT

29

- (2) INFORMATION FOR SEQ ID NO:30:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 29 base pairs
  - (B) TYPE: nucleic acid
  - (C) STRANDEDNESS: single
  - (D) TOPOLOGY: linear
- (ii) MOLECULE TYPE: other nucleic acid
  - (A) DESCRIPTION: /desc = "oligonucleotide"

- (xi) SEQUENCE DESCRIPTION: SEQ ID NO:30:

ANATTTAGGCT TATGCTGACC TCGTTGTA

29

- (2) INFORMATION FOR SEQ ID NO:31:

- (i) SEQUENCE CHARACTERISTICS:
  - (A) LENGTH: 162 amino acids

(B) TYPE: amino acid  
 (C) STRANDEDNESS:  
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:31:

```

Met Gly Asn Ala Ser Tyr Ser Asp Ser Tyr Leu Glu Gly Ile Leu Leu
1           5           10           15

Lys Gly Val Phe Thr Cys Glu Pro Trp Ser Val Ser Val Gly Trp Ser
          20           25           30

Thr Ser Val Asp Cys Gly Trp Phe Gln Ser Ala Trp Leu Arg Ser Ser
          35           40           45

Thr Glu Gly Ser Thr Gly Ala Ala Leu Trp Gln Arg Leu Arg Arg Glu
          50           55           60

Met Asp Gln Pro Thr Pro Gly Thr Trp Leu His Gly Ile Arg Lys Gly
65           70           75           80

Arg Cys Trp Pro Leu Cys Ser Cys Cys Leu Phe Leu Phe Leu Phe Ala
          85           90           95

Phe Asp Leu Val Ala Thr Asp Arg Val Ala Arg Asp Leu Val Phe Ser
          100          105          110

Ser Arg His Pro Ser Thr Pro Ala Leu Ser Gln Val Ser Cys Cys His
          115          120          125

Ala Asn Ala Met Ser Thr Leu Ala Pro Arg Pro Lys Ser Val Gln Arg
          130          135          140

Trp Pro Thr Xaa Ser Ser His Tyr Ser Leu Asn Ser Met Tyr His Leu
145          150          155          160

Pro Leu

```

(2) INFORMATION FOR SEQ ID NO:32:

(i) SEQUENCE CHARACTERISTICS:  
 (A) LENGTH: 83 amino acids  
 (B) TYPE: amino acid  
 (C) STRANDEDNESS:  
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:32:

Leu Val Gly Gly Pro Phe Leu Pro Pro Thr Ser Val Cys Cys Ser Cys  
1 5 10 15

Gln Lys Thr Cys Leu Leu Leu Pro Ala Glu Arg Glu Gln Ser Pro Glu  
20 25 30

His His Gln Glu Cys Leu Leu Val Tyr Trp Gln Leu Ala Thr Pro Ser  
35 40 45

Ser Pro Phe Thr Gln Thr Arg Gly Arg Asp Gly Lys Gly Phe Phe Thr  
50 55 60

Glu His Ser Gly Thr Pro Tyr Arg Arg Lys Leu Asp Arg Leu Val Asn  
65 70 75 80

Gly Phe Ser



What is claimed is:

1. An isolated polynucleotide selected from the group consisting of:
  - (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:1;
  - (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:1 from nucleotide 707 to nucleotide 1783;
  - (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:1 from nucleotide 368 to nucleotide 838;
  - (d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone bp783\_3 deposited under accession number ATCC 98369;
  - (e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone bp783\_3 deposited under accession number ATCC 98369;
  - (f) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone bp783\_3 deposited under accession number ATCC 98369;
  - (g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone bp783\_3 deposited under accession number ATCC 98369;
  - (h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:2;
  - (i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:2 having biological activity, the fragment comprising the amino acid sequence from amino acid 174 to amino acid 183 of SEQ ID NO:2;
  - (j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;
  - (k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and
  - (l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).
2. The polynucleotide of claim 1 wherein said polynucleotide is operably linked to at least one expression control sequence.

3. A host cell transformed with the polynucleotide of claim 2.
4. The host cell of claim 3, wherein said cell is a mammalian cell.
5. A process for producing a protein encoded by the polynucleotide of claim 2, which process comprises:
  - (a) growing a culture of the host cell of claim 3 in a suitable culture medium; and
  - (b) purifying said protein from the culture.
6. A protein produced according to the process of claim 5.
7. The protein of claim 6 comprising a mature protein.
8. A protein comprising an amino acid sequence selected from the group consisting of:
  - (a) the amino acid sequence of SEQ ID NO:2;
  - (b) the amino acid sequence of SEQ ID NO:2 from amino acid 1 to amino acid 44;
  - (c) fragments of the amino acid sequence of SEQ ID NO:2 comprising the amino acid sequence from amino acid 174 to amino acid 183 of SEQ ID NO:2; and
  - (d) the amino acid sequence encoded by the cDNA insert of clone bp783\_3 deposited under accession number ATCC 98369;the protein being substantially free from other mammalian proteins.
9. The protein of claim 8, wherein said protein comprises the amino acid sequence of SEQ ID NO:2.
10. The protein of claim 8, wherein said protein comprises the amino acid sequence of SEQ ID NO:2 from amino acid 1 to amino acid 44.
11. A composition comprising the protein of claim 8 and a pharmaceutically acceptable carrier.

12. A method for preventing, treating or ameliorating a medical condition which comprises administering to a mammalian subject a therapeutically effective amount of a composition of claim 11.

13. An isolated gene corresponding to the cDNA sequence of SEQ ID NO:1.

14. An isolated polynucleotide selected from the group consisting of:

(a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:3;

(b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:3 from nucleotide 99 to nucleotide 1514;

(c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:3 from nucleotide 171 to nucleotide 1514;

(d) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:3 from nucleotide 57 to nucleotide 623;

(e) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone bu45\_2 deposited under accession number ATCC 98369;

(f) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone bu45\_2 deposited under accession number ATCC 98369;

(g) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone bu45\_2 deposited under accession number ATCC 98369;

(h) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone bu45\_2 deposited under accession number ATCC 98369;

(i) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:4;

(j) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:4 having biological activity, the fragment comprising the amino acid sequence from amino acid 231 to amino acid 240 of SEQ ID NO:4;

(k) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(h) above;

(l) a polynucleotide which encodes a species homologue of the protein of (i) or (j) above ; and

(m) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(j).

15. A protein comprising an amino acid sequence selected from the group consisting of:

(a) the amino acid sequence of SEQ ID NO:4;

(b) the amino acid sequence of SEQ ID NO:4 from amino acid 1 to amino acid 175;

(c) fragments of the amino acid sequence of SEQ ID NO:4 comprising the amino acid sequence from amino acid 231 to amino acid 240 of SEQ ID NO:4; and

(d) the amino acid sequence encoded by the cDNA insert of clone bu45\_2 deposited under accession number ATCC 98369;

the protein being substantially free from other mammalian proteins.

16. An isolated gene corresponding to the cDNA sequence of SEQ ID NO:3.

17. An isolated polynucleotide selected from the group consisting of:

(a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:5;

(b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:5 from nucleotide 87 to nucleotide 980;

(c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:5 from nucleotide 147 to nucleotide 980;

(d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone ct864\_4 deposited under accession number ATCC 98369;

(e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone ct864\_4 deposited under accession number ATCC 98369;

(f) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone ct864\_4 deposited under accession number ATCC 98369;

(g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone ct864\_4 deposited under accession number ATCC 98369;

(h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:6;

(i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:6 having biological activity, the fragment comprising the amino acid sequence from amino acid 144 to amino acid 153 of SEQ ID NO:6;

(j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;

(k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and

(l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).

18. A protein comprising an amino acid sequence selected from the group consisting of:

(a) the amino acid sequence of SEQ ID NO:6;

(b) the amino acid sequence of SEQ ID NO:6 from amino acid 189 to amino acid 290;

(c) fragments of the amino acid sequence of SEQ ID NO:6 comprising the amino acid sequence from amino acid 144 to amino acid 153 of SEQ ID NO:6; and

(d) the amino acid sequence encoded by the cDNA insert of clone ct864\_4 deposited under accession number ATCC 98369;

the protein being substantially free from other mammalian proteins.

19. An isolated gene corresponding to the cDNA sequence of SEQ ID NO:5.

20. An isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:7;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:7 from nucleotide 242 to nucleotide 580;
- (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:7 from nucleotide 1 to nucleotide 387;
- (d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone df396\_1 deposited under accession number ATCC 98369;
- (e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone df396\_1 deposited under accession number ATCC 98369;
- (f) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone df396\_1 deposited under accession number ATCC 98369;
- (g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone df396\_1 deposited under accession number ATCC 98369;
- (h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:8;
- (i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:8 having biological activity, the fragment comprising the amino acid sequence from amino acid 51 to amino acid 60 of SEQ ID NO:8;
- (j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;
- (k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and
- (l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).

21. A protein comprising an amino acid sequence selected from the group consisting of:

- (a) the amino acid sequence of SEQ ID NO:8;
- (b) the amino acid sequence of SEQ ID NO:8 from amino acid 1 to amino acid 48;

- (c) fragments of the amino acid sequence of SEQ ID NO:8 comprising the amino acid sequence from amino acid 51 to amino acid 60 of SEQ ID NO:8; and
  - (d) the amino acid sequence encoded by the cDNA insert of clone df396\_1 deposited under accession number ATCC 98369;
- the protein being substantially free from other mammalian proteins.

22. An isolated gene corresponding to the cDNA sequence of SEQ ID NO:7.

23. An isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:9;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:9 from nucleotide 236 to nucleotide 1213;
- (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:9 from nucleotide 1386 to nucleotide 1833;
- (d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone dh1135\_9 deposited under accession number ATCC 98369;
- (e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone dh1135\_9 deposited under accession number ATCC 98369;
- (f) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone dh1135\_9 deposited under accession number ATCC 98369;
- (g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone dh1135\_9 deposited under accession number ATCC 98369;
- (h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:10;
- (i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:10 having biological activity, the fragment comprising the amino acid sequence from amino acid 157 to amino acid 166 of SEQ ID NO:10;
- (j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;

(k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and

(l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).

24. A protein comprising an amino acid sequence selected from the group consisting of:

(a) the amino acid sequence of SEQ ID NO:10;

(b) the amino acid sequence of SEQ ID NO:31 from amino acid 1 to amino acid 147;

(c) fragments of the amino acid sequence of SEQ ID NO:10 comprising the amino acid sequence from amino acid 157 to amino acid 166 of SEQ ID NO:10; and

(d) the amino acid sequence encoded by the cDNA insert of clone dh1135\_9 deposited under accession number ATCC 98369;

the protein being substantially free from other mammalian proteins.

25. An isolated gene corresponding to the cDNA sequence of SEQ ID NO:9.

26. An isolated polynucleotide selected from the group consisting of:

(a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:11;

(b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:11 from nucleotide 334 to nucleotide 675;

(c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:11 from nucleotide 409 to nucleotide 675;

(d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone dn809\_5 deposited under accession number ATCC 98369;

(e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone dn809\_5 deposited under accession number ATCC 98369;



(f) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone dn809\_5 deposited under accession number ATCC 98369;

(g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone dn809\_5 deposited under accession number ATCC 98369;

(h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:12;

(i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:12 having biological activity, the fragment comprising the amino acid sequence from amino acid 52 to amino acid 61 of SEQ ID NO:12;

(j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;

(k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and

(l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).

27. A protein comprising an amino acid sequence selected from the group consisting of:

(a) the amino acid sequence of SEQ ID NO:12;

(b) the amino acid sequence of SEQ ID NO:12 from amino acid 1 to amino acid 110;

(c) fragments of the amino acid sequence of SEQ ID NO:12 comprising the amino acid sequence from amino acid 52 to amino acid 61 of SEQ ID NO:12; and

(d) the amino acid sequence encoded by the cDNA insert of clone dn809\_5 deposited under accession number ATCC 98369;

the protein being substantially free from other mammalian proteins.

28. An isolated gene corresponding to the cDNA sequence of SEQ ID NO:11.

29. An isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:13;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:13 from nucleotide 447 to nucleotide 791;
- (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:13 from nucleotide 597 to nucleotide 791;
- (d) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:13 from nucleotide 1 to nucleotide 546;
- (e) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone ej224\_1 deposited under accession number ATCC 98369;
- (f) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone ej224\_1 deposited under accession number ATCC 98369;
- (g) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone ej224\_1 deposited under accession number ATCC 98369;
- (h) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone ej224\_1 deposited under accession number ATCC 98369;
- (i) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:14;
- (j) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:14 having biological activity, the fragment comprising the amino acid sequence from amino acid 52 to amino acid 61 of SEQ ID NO:14;
- (k) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(h) above;
- (l) a polynucleotide which encodes a species homologue of the protein of (i) or (j) above ; and
- (m) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(j).

30. A protein comprising an amino acid sequence selected from the group consisting of:

- (a) the amino acid sequence of SEQ ID NO:14;

- (b) the amino acid sequence of SEQ ID NO:14 from amino acid 82 to amino acid 100;
  - (c) fragments of the amino acid sequence of SEQ ID NO:14 comprising the amino acid sequence from amino acid 52 to amino acid 61 of SEQ ID NO:14; and
  - (d) the amino acid sequence encoded by the cDNA insert of clone ej224\_1 deposited under accession number ATCC 98369;
- the protein being substantially free from other mammalian proteins.

31. An isolated gene corresponding to the cDNA sequence of SEQ ID NO:13.

32. An isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:15;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:15 from nucleotide 18 to nucleotide 347;
- (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:15 from nucleotide 1 to nucleotide 345;
- (d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone ek591\_1 deposited under accession number ATCC 98369;
- (e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone ek591\_1 deposited under accession number ATCC 98369;
- (f) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone ek591\_1 deposited under accession number ATCC 98369;
- (g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone ek591\_1 deposited under accession number ATCC 98369;
- (h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:16;
- (i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:16 having biological activity, the fragment comprising the amino acid sequence from amino acid 50 to amino acid 59 of SEQ ID NO:16;

- (j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;
- (k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and
- (l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).

33. A protein comprising an amino acid sequence selected from the group consisting of:

- (a) the amino acid sequence of SEQ ID NO:16;
- (b) the amino acid sequence of SEQ ID NO:16 from amino acid 1 to amino acid 109;
- (c) fragments of the amino acid sequence of SEQ ID NO:16 comprising the amino acid sequence from amino acid 50 to amino acid 59 of SEQ ID NO:16; and
- (d) the amino acid sequence encoded by the cDNA insert of clone ek591\_1 deposited under accession number ATCC 98369;

the protein being substantially free from other mammalian proteins.

34. An isolated gene corresponding to the cDNA sequence of SEQ ID NO:15.

35. An isolated polynucleotide selected from the group consisting of:

- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:17;
- (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:17 from nucleotide 593 to nucleotide 1663;
- (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:17 from nucleotide 833 to nucleotide 1663;
- (d) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:17 from nucleotide 648 to nucleotide 1063;
- (e) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone er381\_1 deposited under accession number ATCC 98369;

- (f) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone er381\_1 deposited under accession number ATCC 98369;
- (g) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone er381\_1 deposited under accession number ATCC 98369;
- (h) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone er381\_1 deposited under accession number ATCC 98369;
- (i) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:18;
- (j) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:18 having biological activity, the fragment comprising the amino acid sequence from amino acid 173 to amino acid 182 of SEQ ID NO:18;
- (k) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(h) above;
- (l) a polynucleotide which encodes a species homologue of the protein of (i) or (j) above ; and
- (m) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(j).

36. A protein comprising an amino acid sequence selected from the group consisting of:

- (a) the amino acid sequence of SEQ ID NO:18;
- (b) the amino acid sequence of SEQ ID NO:18 from amino acid 20 to amino acid 157;
- (c) fragments of the amino acid sequence of SEQ ID NO:18 comprising the amino acid sequence from amino acid 173 to amino acid 182 of SEQ ID NO:18; and
- (d) the amino acid sequence encoded by the cDNA insert of clone er381\_1 deposited under accession number ATCC 98369;

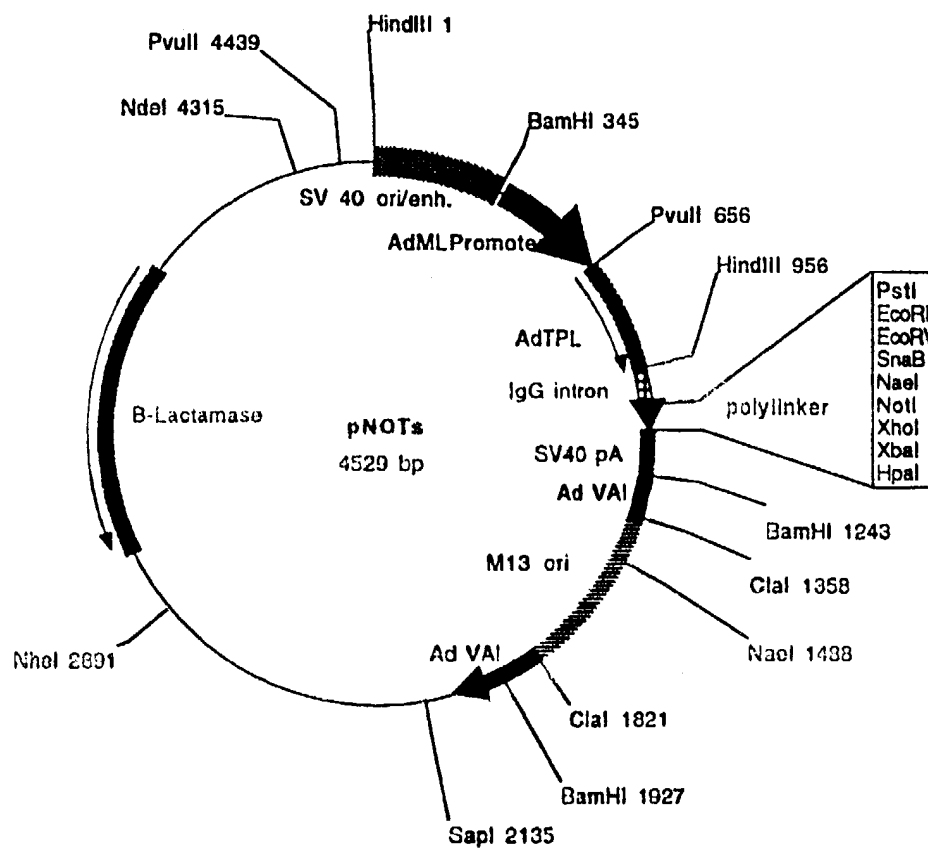
the protein being substantially free from other mammalian proteins.

37. An isolated gene corresponding to the cDNA sequence of SEQ ID NO:17.

38. An isolated polynucleotide selected from the group consisting of:
- (a) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:19;
  - (b) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:19 from nucleotide 1055 to nucleotide 1246;
  - (c) a polynucleotide comprising the nucleotide sequence of SEQ ID NO:19 from nucleotide 759 to nucleotide 1152;
  - (d) a polynucleotide comprising the nucleotide sequence of the full-length protein coding sequence of clone gq38\_1 deposited under accession number ATCC 98369;
  - (e) a polynucleotide encoding the full-length protein encoded by the cDNA insert of clone gq38\_1 deposited under accession number ATCC 98369;
  - (f) a polynucleotide comprising the nucleotide sequence of a mature protein coding sequence of clone gq38\_1 deposited under accession number ATCC 98369;
  - (g) a polynucleotide encoding a mature protein encoded by the cDNA insert of clone gq38\_1 deposited under accession number ATCC 98369;
  - (h) a polynucleotide encoding a protein comprising the amino acid sequence of SEQ ID NO:20;
  - (i) a polynucleotide encoding a protein comprising a fragment of the amino acid sequence of SEQ ID NO:20 having biological activity, the fragment comprising the amino acid sequence from amino acid 20 to amino acid 29 of SEQ ID NO:20;
  - (j) a polynucleotide which is an allelic variant of a polynucleotide of (a)-(g) above;
  - (k) a polynucleotide which encodes a species homologue of the protein of (h) or (i) above ; and
  - (l) a polynucleotide capable of hybridizing under stringent conditions to any one of the polynucleotides specified in (a)-(i).
39. A protein comprising an amino acid sequence selected from the group consisting of:
- (a) the amino acid sequence of SEQ ID NO:20;



FIGURE 1B

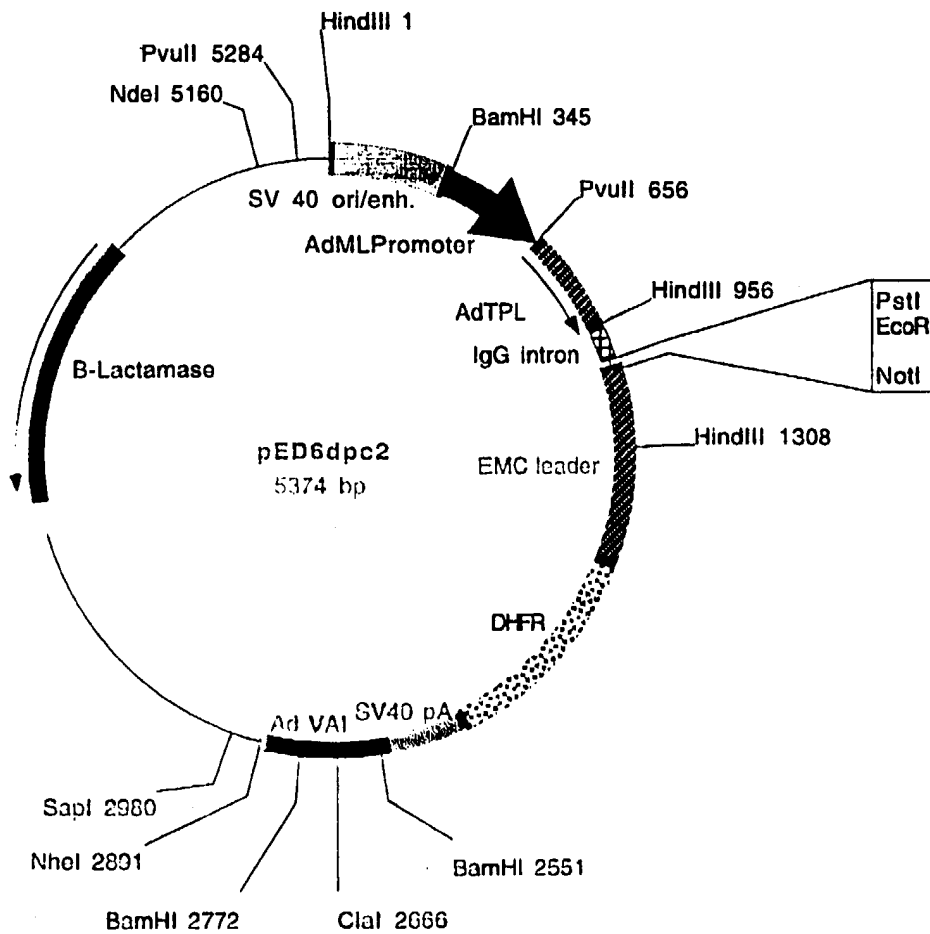


**Plasmid name:** pNOTs  
**Plasmid size:** 4529 bp

**Comments/References:** pNOTs is a derivative of pMT2 (Kaufman et al, 1989. Mol. Cell. Biol. 9:1741-1750). DHFR was deleted and a new polylinker was inserted between EcoRI and HpaI. M13 origin of replication was inserted in the ClaI site. SST cDNAs are cloned between EcoRI and NotI



FIGURE 1A



**Plasmid name:** pED6dpc2

**Plasmid size:** 5374 bp

**Comments/References:** pED6dpc2 is derived from pED6dpc1 by insertion of a new polylinker to facilitate cDNA cloning. SST cDNAs are cloned between EcoRI and NotI. pED vectors are described in Kaufman et al.(1991), NAR 19: 4485-4490.

- (b) the amino acid sequence of SEQ ID NO:20 from amino acid 1 to amino acid 32;
  - (c) fragments of the amino acid sequence of SEQ ID NO:20 comprising the amino acid sequence from amino acid 20 to amino acid 29 of SEQ ID NO:20; and
  - (d) the amino acid sequence encoded by the cDNA insert of clone gq38\_1 deposited under accession number ATCC 98369;
- the protein being substantially free from other mammalian proteins.

40. An isolated gene corresponding to the cDNA sequence of SEQ ID NO:19.